GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION
SPONSORED PROJECT INITIATION

Date: 10/9/79

Project Title: "Telecommunications Consultation and Analytical Services for Volunteer Electric Cooperative"

Project No: A-2463

Project Director: ~~C. S. Wilson~~ R. W. Rice

Sponsor: Volunteer Electric Cooperative

Agreement Period: From 9/18/79 Until ~~9/17/80~~ 81 8/31/82

Type Agreement: Standard Industrial Agreement dated 9/18/79

Amount: $5,000

Reports Required: Letter Report (upon completion of each task)

Sponsor Contact Person (s):

Technical Matters

Contractual Matters
(thru OCA)

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Defense Priority Rating: N/A

Assigned to: ET/CSB (School/Laboratory)

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GEORGIA INSTITUTE OF TECHNOLOGY **OFFICE OF CONTRACT ADMINISTRATION**

SPONSORED PROJECT TERMINATION SHEET

Date 3/2/83

Project Title: "Telecommunications Consultation and Analytical Services for Volunteer Electric Cooperative"

Project No: A-2463

Project Director: R. W. Rice

Sponsor: Volunteer Electric Cooperative

Effective Termination Date: 8/31/82

Clearance of Accounting Charges: 8/31/82

Grant/Contract Closeout Actions Remaining:

- [x] Final Invoice ~~and Closing Documents~~
- [ ] Final Fiscal Report
- [ ] Final Report of Inventions
- [ ] Govt. Property Inventory & Related Certificate
- [ ] Classified Material Certificate
- [ ] Other ____________

Assigned to: ECSL/CSD (School/Laboratory)

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STUDY AND EVALUATION OF THE VOLUNTEER ELECTRIC COOPERATIVE COMMUNICATIONS SYSTEM

By

Charles S. Wilson, Project Director
Bobby J. Wilson

Prepared for

VOLUNTEER ELECTRIC COOPERATIVE
P. O. Box 277
Decatur, Tennessee 37322

Under

Project A-2463

COMMUNICATIONS SYSTEMS DIVISION
ELECTRONICS TECHNOLOGY LABORATORY
Engineering Experiment Station
Georgia Institute of Technology

March 1980

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FOREWORD

This study was conducted by the Engineering Experiment Station at Georgia Tech. The work was performed in the Electronics Technology Laboratory, Mr. D. W. Robertson, Director, and was conducted under the general supervision and management of Mr. R. W. Moss, Chief of the Communications System Division. C. S. Wilson was project director.

The assistance of Mr. Jerry Dover, General Manager, Volunteer Electric Cooperative is gratefully acknowledged as is the cooperation of numerous VEC employees.

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1.0 INTRODUCTION

Based on needs of Volunteer Electric Cooperative to improve several aspects of its general operations, Georgia Tech has undertaken the task of analyzing these operational areas and to provide recommendations based on this analysis. Five operational, and operationally related areas were investigated: (1) centralized dispatching, (2) supervisory control, (3) land-mobile communications, (4) data processing, and (5) load management.

One area, particularly land-mobile communications, received more attention than others because of its importance to overall operations and because of its interrelation with other problem areas. As an example, both supervisory control and load management have a relationship to land-mobile services in that all three could utilize radio signaling. In addition, centralized dispatching, perhaps to a large degree, also involves radio communications as well as other general operational aspects.

Due to the limited scope of this effort it was not possible to accomplish an in-depth evaluation of all five areas. Even those areas which did receive considerable attention, notably land-mobile communications, were certainly not exhaustively analyzed; additional study is needed. Guidelines are provided which should furnish Volunteer Electric Cooperative with the necessary background for planning of both present and future needs.

2.0 PRESENT VEC COMMUNICATIONS SYSTEM

2.1 Survey of the VEC Communications System

A major effort during the program was to survey all of the district and sub-offices within the Volunteer Electric Cooperative. The purpose of this survey was to interview personnel at each of the district and sub-offices to obtain a data base on their present communications system.

The data base contains information on land-mobile radio, telephone and data processing systems. This data base will be useful to determine:

- Operational performance of the present radio system.
- Coverage problems within each district.
- Future needs of the Volunteer Electric Cooperative.
- Recommendation for improving communications within the Volunteer Electric Cooperative districts.

The survey was performed by visiting each of the nine (9) offices within the Volunteer Electric Cooperative and by discussing with their personnel the problem areas within each district. Table 1 lists the personnel who were interviewed during the VEC survey. The results of this survey are summarized in the following paragraphs.

It is important to note that within Section 2 of this report, problem areas which are identified as well as suggested solutions reflects information provided by VEC personnel. Problem areas and suggested solutions based on Georgia Tech's recommendations are contained in Sections 3 and 4.

2.2 VEC Survey Results

2.2.1 Decatur - District Office

The Decatur district office communications system consists primarily of a radio control link to Cottonport Ridge. Figure 1 is a block diagram of the control link to Cottonport Ridge. This control link is shared with two other VEC offices, the Cleveland district and Georgetown sub-office. Figure 2 shows a typical VEC transmitter control block diagram.

The performance of the control link between the three offices is satisfactory. The control link, when activated, transmits on 72.94 MHz and receives on 75.92 MHz. This signal, when decoded, activates the 37.86 transmitter which allows for two-way communications between the base station and mobiles.

The coverage problems that exist at the Decatur district office are areas to the north in Roan County and to the south in Hamilton County. Problem areas other than coverage that were noted at the Decatur district office were:

- Noise buildup during thunderstorms at the Cottonport facility.
- Co-channel interference.
- Unnecessary communications over the channels.

Table 2 shows the approximate percentage of coverage area for all of the VEC offices. The table indicates that the largest areas of poor coverage are the Decatur district; Hamilton County; Georgetown office; and Benton office. The communications system analysis will therefore be centered around these particular areas. Tables 3 and 4 list the parameters for all of the VEC communications system which will be used in the land mobile analysis.

Table 1

VEC INTERVIEW SCHEDULE

VEC District/Sub-office	Persons Interviewed
Decatur and Decatur District	Jerry Dover, General Manager Charles P. Anderson, Assistant General Manager Tilmon Grishman, Operations Superintendent Richard Jones and Clyde Jolley, Communication & Electronics Coordinators Phyllis Legg, Data Processing Supervisor Tom Elder, District Manager Joe Buchanan, District Operations Supervisor Barbara Goodner, Office Supervisor
Georgetown (Hamilton County)	Jimmy White, Service Foreman Sharon Aikman, Cashier-Receptionist
Cleveland	Herman Milton, District Manager Oscar Pirkle, District Operations Supervisor Ann Ricks, District Office Supervisor
Benton	Reed Moses, Service Foreman Clydene Brown, Cashier-Receptionist
Spring City	Glen Smith, Service Foreman Pam Kirkland, Cashier-Receptionist
Crossville	Lyle Williams, District Manager James Lindsey, District Operations Supervisor Sue Breeden, District Office Supervisor
Monterey	Bobby Randolph, District Manager Fred Sutton, Service Foreman Barbara Tays, District Office Supervisor

Jamestown	Clyde Bease, District Manager Opal Manis, District Office Supervisor
Byrdstown	Joe Huddleston, Service Foreman Phyllis Whittenburg, Cashier-Receptionist

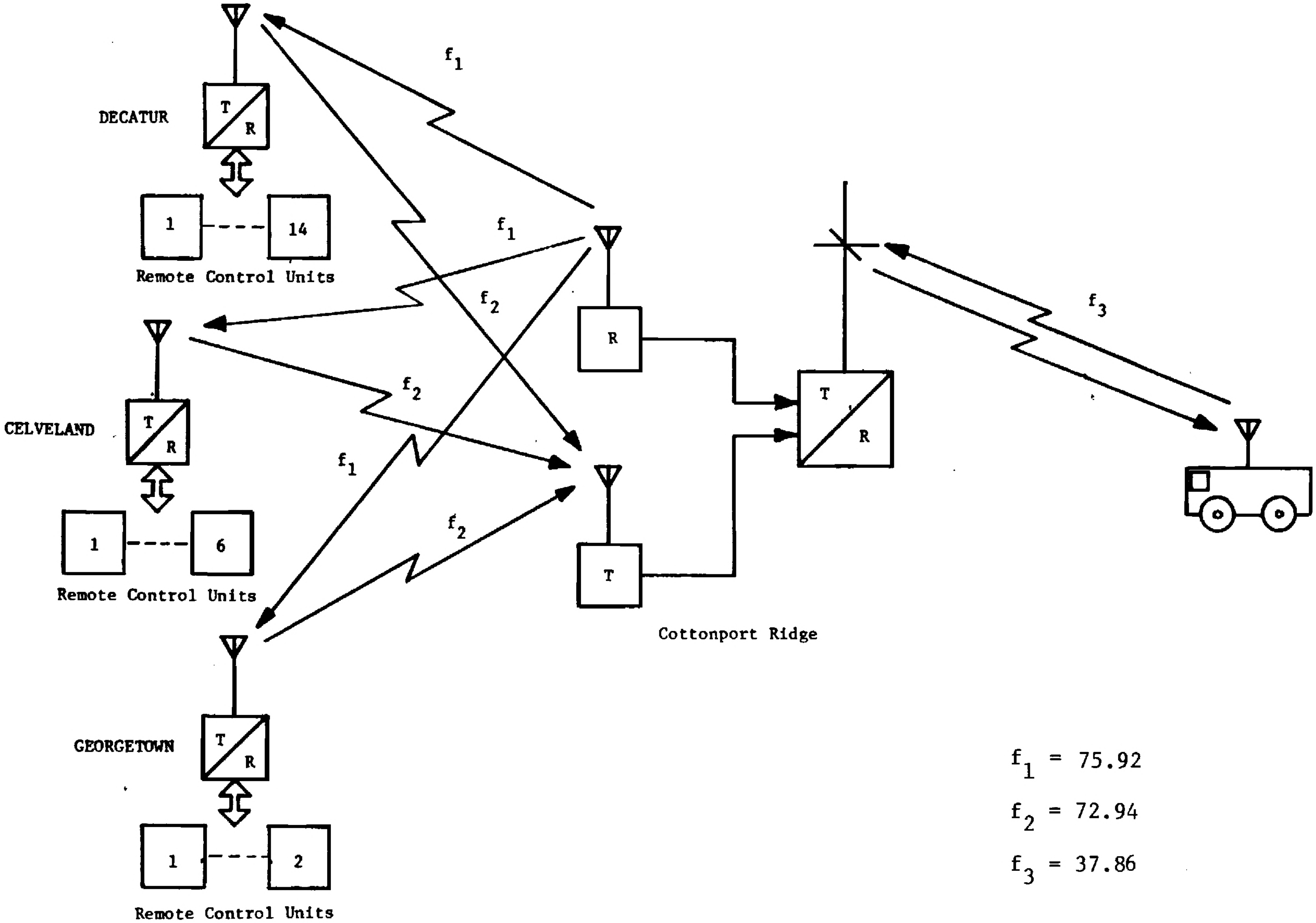


Figure 1 Simplified Block Diagram of Control Link

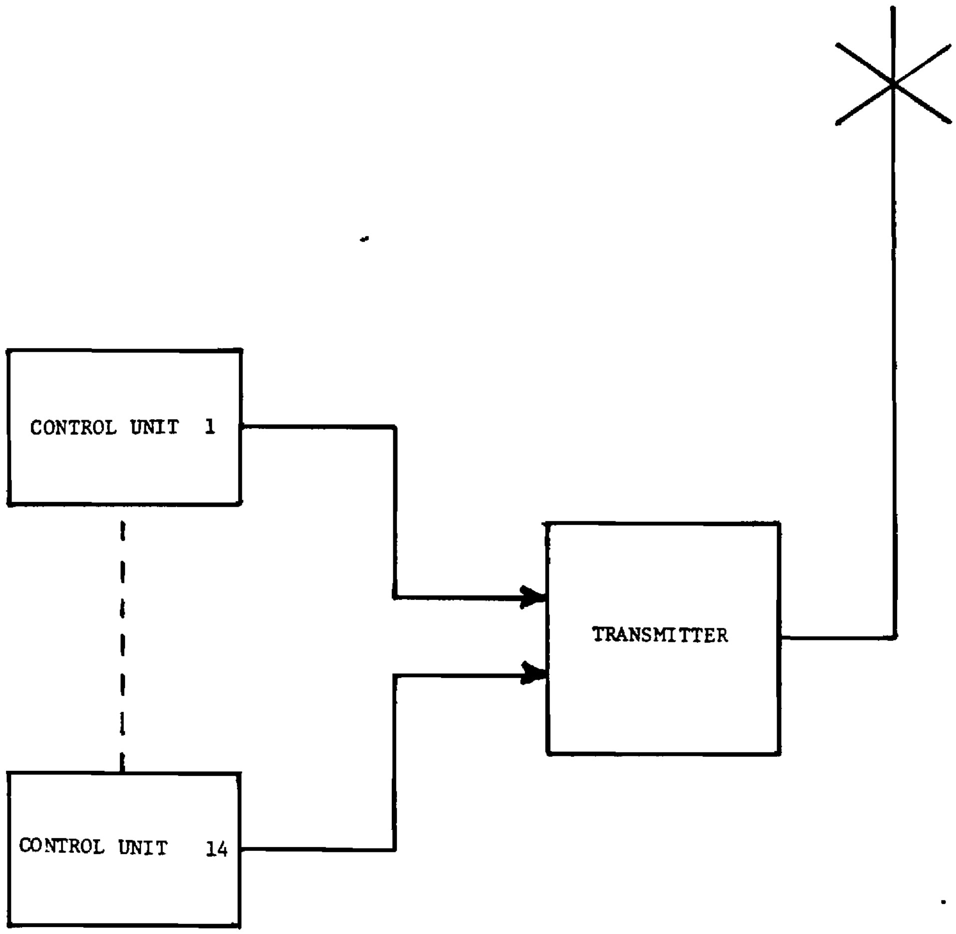


Figure 2 Typical VEC Transmitter Control Block Diagram

Table 2

VEC RADIO SYSTEM PERFORMANCE

Approximate District Coverage		Radio Communication Quality			
Location	Percent Coverage	Excellent	Good	Fair	Poor
Decatur	85			X	
Georgetown	75			X	
Cleveland	75			X	
Benton	60				X
Spring City	90		X		
Crossville	95	X			
Monterey	80			X	
Jamestown	90		X		
Byrdstown	90		X		

Table 3

VEC ANTENNA PARAMETERS

Location	Type	Gain/db	Height/ft	Mounting Structure	MSL/ft	Transmission Line Type	Transmission Line Length/ft
Decatur	DB-225	5	50	tower	1000	RG/8	30
Cottonport Ridge	DB-225	5	40	tower	1000	RG/8	30
	DB-201	0	90	tower	1000	RG/8	130
Georgetown	DB-225	5	45	pole	798	RG/8	30
Cleveland	DB-225	5	50	tower	870	RG/8	120
Benton	DB-201	0	50	pole	795	RG/8	100
Spring City	DB-201	0	45	pole	770	RG/8	75
Crossville	DB-201	0	70	pole	1850	RG/8	140
Monterey	DB-201	0	70	tower	1885	RG/8	100
Jamestown	DB-201	0	50	tower	2743	RG/8	100
Byrdstown	$\lambda/2$ Helix	-	50	pole	1235	RG/8	90

Table 4
VEC BASE STATION PARAMETERS

Location	Transceiver Type	Frequency MHz	Number Channels	Operating freq/MHz	Emission Type	Modulation KHz	Number of Control Points	Output Power/Watts
Decatur	GE DM-54-RAS	72.94	1	72.94	20F3	12	14	30
Cottonport Ridge	GE DM-54-YAS	72.94	1	72.94	20F3	12	—	30
	GE DM-74	37.58 37.86	2	37.86	20F3	12	--	100
Georgetown	GE 8511732	72.94	1	72.94	20F3	12	2	30
Cleveland	GE DM-54-RAS	72.94	1	72.94	20F3	12	2	30
Benton	GE DM 74	37.58 37.86	2	37.86	20F3	12	2	100
Spring City	GE D7-74KCW-22	37.58 37.86	2	37.86	20F3	12	2	100
Crossville	GE VT-94TCW-22	37.58 37.86	2	37.58	20F3	12	3	330
Monterey	GE DM-74	37.58 37.86	2	37.58	20F3	12	3	100
Jamestown	GE VT-94TCW-22	37.58 37.86	2	37.58	20F3	12	3	330
Byrdstown	GE DM-74	37.58 37.86	2	37.58	20F3	12	1	100

During the VEC survey it was noted that a significant amount of communications was being conducted between a base station of one VEC office and a base station of another VEC office having different call signs. According to the FCC rules and regulations, this is not permitted, except under emergency conditions. The rules and regulations that cover this particular station-to-station operation is explained in more detail in Appendix C.

The telephone system at the Decatur district office is a Dimension type and its features are listed in Appendix A. The present telephone system appears to be adequate for handling the existing load. Special telephone communications features for the Decatur office are provided in Table 5. Appendix A and Table 5 also list telephone system features of the other VEC offices.

The data processing facility located at the Decatur district office consists of a Sperry Univac 90/30 computer. Each district office and sub-office has a dedicated leased line which is connected to the computer for entering data. The system uses a printer, single station display, and a 201 modem located at each of the district and sub-offices. These units are the primary input and output (I/O) devices for the customer accounts.

The data processing system provides real-time accounting information based on terminal inputs. Data are maintained as needed to bill customers, post cash payments, post meter readings, and produce accounting reports and customer information. A complete equipment list for the leased computer system is shown in Appendix B. Table 6 summarizes the data communication equipment at each of the VEC offices.

The major problem noted by all Volunteer Electric Cooperative personnel was the slow response time during peak usage of the computer by other VEC offices when meter reading data was entered into the computer for processing.

2.2.2 Georgetown and Hamilton County Sub-office

With the communications equipment presently installed at the Georgetown sub-office, approximately 75 percent of this district can be adequately covered. The land-mobile equipment is summarized in Tables 3 and 4. These parameters will be used in the coverage analysis of the VEC land-mobile system.

The Georgetown sub-office shares the Cottonport Ridge VHF transmitter facilities with the Decatur and Cleveland offices via the radio control link. According to VEC personnel the radio control link to Cottonport Ridge is performing satisfactorily. However, the major problem lies with the relay-to-mobile VHF transceiver which prevents adequate coverage in the area approximately 7-8 miles to the south and approximately 15-16 miles to the north. There are also some minor coverage problems in and around the Tennessee River. Communications between mobiles within their district is

Table 5

VEC SPECIAL COMMMUNICATION FEATURES

VEC District/Sub-office	Phone Patch	Private Lines	Base Remote Control	Tone Signaling
Decatur	No	No	Yes	Yes
Georgetown	No	No	Yes	No
Cleveland	No	Yes	Yes	No
Benton	No	Yes	Yes	No
Spring City	No	No	Yes	No
Crossville	No	Yes	Yes	No
Monterey	No	Yes	Yes	No
Jamestown	No	Yes	No	No
Byrdstown	No	Yes	No	No

Table 6

DATA COMMUNICATION SUMMARY

VEC District/Sub-office	Type Computer Service	Number of Terminals	Number of Displays	Quality
Decatur	Univac 90/30	3	3	Good
Georgetown	----	1	1	Good
Cleveland	----	1	1	Good
Benton	----	1	1	Good
Spring City	----	1	1	Good
Crossville	----	1	1	Good
Monterey	----	1	1	Good
Jamestown	----	1	1	Good
Byrdstown	----	1	1	Good

good. However, a need to improve communications with other mobiles outside their district was mentioned. Other problems with the communications system were co-channel interference, noise buildup during thunderstorms, and no emergency communications equipment.

Overall, the telephone communications were good. However, some need was expressed for a WATS line, beepers and centralized dispatching.

2.2.3 Cleveland District Office

The Cleveland district shares the Cottonport Ridge VHF transmitter facilities with the Decatur and Georgetown offices. The control link to the Cottonport Ridge is performing satisfactorily. With the present equipment installed at the Cleveland office, adequate coverage exists over approximately 75 percent of the district.

A major problem lies with the VHF transmitter located at Cottonport Ridge which prevents adequate coverage to the areas in the Southern end of the district, specifically to the Georgia line and to the eastern side of Chilhowee Mountain.

Other problems with the communications system other than coverage were noise buildup during thunderstorms or approaching bad weather, co-channel interference, and no emergency communications equipment.

The mobile-to-mobile communications within the district were adequate, but a need was expressed for better communications with mobiles of other districts.

The overall telephone and data communications are adequate at the present time. However, a need was expressed for centralized dispatching and supervisory control.

2.2.4 Benton Sub-office

The Benton sub-office communications system and antenna parameters are listed in Tables 3 and 4. With the present communications system, the Benton sub-office can cover approximately 60 percent of their area. The information obtained from the VEC personnel indicates that Benton has the poorest coverage of all the VEC offices. The main areas of poor coverage are to the north around the Reliance area, (behind Chilhowee Mountain), to the south in the Cookston Creek area, and from Highway 64 south to the Georgia line.

Communications problems other than coverage were co-channel interference and noise buildup during thunderstorms. A need was also expressed for an answering service or some form of centralized dispatching to allow more freedom for personnel after normal working hours. The overall telephone and data processing equipment are adequate to handle the present workload.

2.2.5 Spring City Sub-office

With the present communications system at the Spring City sub-office, approximately 90 percent of their area can be covered. The remaining 10% not adequately covered includes two areas: one located to the southeast in the Evensville area, and the other in the Roddy area located approximately 14 miles northeast of Spring City.

Communications problems other than coverage were co-channel interference, noise buildup during thunderstorms and unnecessary communications on the channel.

Also, a need was expressed for obtaining walkie-talkies, answering service, beepers and a WATS line.

The overall telephone and data communications equipment are adequate to handle the present workload. However, an answering service or beeper would allow more freedom for personnel on standby after normal working hours.

2.2.6 Crossville District Office

The communications system presently installed at the Crossville office can cover approximately 95 percent of their area. The area not adequately covered is Sequatchie Valley located approximately 30 miles south of Crossville.

Communications problems other than coverage were radio co-channel interference, unnecessary communication on the channels, and lack of an emergency communications system. The use of walkie-talkies would be helpful, especially during installation of new lines or troubleshooting. A strong need was expressed for some form of centralized dispatching and supervisory control system.

The telephone and data communications system appear to be adequate to handle present load conditions. However, the use of the beeper service requires a long distance phone call.

2.2.7 Monterey District

The communications system as presently installed in Monterey can adequately cover approximately 80% of the area. Coverage between mobiles within this district is good but depends on vehicle location. However, communications with mobiles in other districts needs to be improved for safety reasons.

The radio coverage problems include the area between the Mayland and Pleasant Hill communities, located southeast of Monterey, and the Wilder Community, located northeast of Monterey.

Communications problems other than coverage at Monterey include co-channel interference and unnecessary communications on the channels. The use of beepers has been a big help but there is a real need for walkie-talkies for this district.

The telephone and data communications system appears to be adequate for the present load condition. However, approximately 50 percent of the customers must make a long distance phone call in order to report a problem. This could possibly be eliminated by the installation of an 800 number. The need for some type of centralized dispatching and supervisory control is considered a must in the near future.

2.2.8 Jamestown District

The communications equipment presently installed within the Jamestown District can cover approximately 90 percent of their district. The overall quality is good but there is a need to improve mobile-to-mobile communications to other districts. The area of major difficulty is north of Jamestown around Wolf Mountain. However, the problem is not considered to be of major importance.

Communication problems other than coverage were: co-channel interference, which can be overriden most of the time, no answering service in Monterey but it is definitely needed because they get approximately 90 percent of trouble calls at home.

The telephone system appears to be inadequate to handle the present load, especially during emergency conditions or when there is more than one outage area.

2.2.9 Byrdstown Sub-office

The communications system as presently installed at Byrdstown can cover approximately 90 percent of their area. The areas where land-mobile coverage is marginal are to the north in Canny Creek; the Star Point Camp, which is located in a valley; and the Vans Branch area, located around the Dale Lake region. There are approximately 200 customers in these areas. The communications with mobiles within the district is good but an improvement is desired in the communications between mobiles in the other districts.

A radio communications problem other than land-mobile coverage that exists at Byrdstown was the co-channel interference. There is no answering service in the Byrdstown area, an answering service which is definitely needed, especially at night and during emergency calls.

At present, the telephone and data communications system appears to be adequate for the existing load.

3.0 ANALYSIS OF LAND-MOBILE COMMUNICATIONS SYSTEM

3.1 General Considerations - Southern Area

Within Volunteer Electric Cooperative (VEC), the Southern and Northern areas are treated separately in that considerable responsibility is vested within the two areas. In certain respects, this is appropriate considering the large geographical area serviced by VEC. It may also be appropriate to divide VEC into Northern and Southern areas for land-mobile radio services if an extensive radio relay system is to be avoided.

The land area serviced by VEC is some 110 miles in a north - south direction and approximately 48 miles in an east - west direction. In comparing Northern and Southern areas there is a significant difference in terrain in that the Southern region is rolling country with most mountains and ridges being about 200 to 400 feet above average terrain. Moving in a northerly direction, however, the terrain becomes considerably more mountainous.

The Southern region contains a higher population density than does the Northern section and thus, strictly from a cost-effectiveness standpoint, radio coverage in the south is of primary importance. By way of example, if there are land areas in the Northern region which could only be covered through installation of an extensive radio relay system but these areas contain a small number of customers and associated power feeders, then occasionally having to drive a mobile unit one or two miles in order to establish communications may be an acceptable inconvenience when compared with the cost of a radio relay system.

It is perhaps fortunate that the majority of land-mobile communication problems which do exist are in the Southern region, since this area is less mountainous than in the North and thus most radio communication problems can be resolved without undue difficulty. It is probably safe to assume, however, that a major reason for a smaller number of problems within the Northern district is largely due to the smaller population distribution. The potential for problems is greater in the North, because of the geographical terrain.

In an attempt to solve the existing land-mobile communication problems, a number of alternatives were considered, alternatives which are evaluated in sections to follow.

3.1.1 Radio Coverage Analysis

Cottonport Tower In an attempt to provide adequate land-mobile communications within the Southern region of VEC, a radio relay was, at an earlier date, placed on Cottonport Ridge. This radio relay shares an existing TVA microwave tower which is some 90 feet in height. The radio relay consists of 72.94 and 75.92 MHz links between base stations and the relay tower and then a 37.86 MHz link between the relay tower and mobile units. The base-to-relay antenna height at Cottonport is 50 feet, whereas the antenna for the relay-to-mobile is about 90 feet up the tower. In both cases the antennas are omni-directional and have a gain of OdB.

Based on our interviews with VEC personnel, the major geographical limitations on land-mobile coverage through use of this radio relay is into extreme northern areas of the Southern district (i.e. toward and beyond the Ten-Mile substation) and into the extreme southern areas (e.g. the McDonald sub-station and surrounding areas). The 72.94 and 75.92 MHz base-to-relay links provide satisfactory performance.

Utilizing the equipment parameters provided by VEC, and as tabulated in Tables 3 and 4, radio coverage calculations were performed both for the existing radio relay at Cottonport and for an improved Cottonport facility.

The radio coverage calculations were performed through utilization of a Georgia Tech-developed, computer-based, radio propagation model. The computer-based model has been used for numerous, specific applications, including planning of load management systems for EMC's within the state of Georgia.

Utilizing the computer model and known parameters of the Cottonport radio relay, the resulting coverage is presented in the computer plot of Figure 3. Note that the geographical area covered by this plot covers the entire southern region. For reader convenience, a computer plot of this same geographical region, but without the associated symbols is presented in Figure 4.

For all radio coverage plots presented in this report, Site #1 is the transmitter location from which the coverage calculations are performed. Thus, in Figures 3, 4, 5 and 6, Site #1 is Cottonport but in Figure 7 Site #1 is Oswald Dome and Cottonport now assumes Oswald Dome's former position of Site #10. In other figures to follow, the same interchange procedure is used.

An explanation of the graphics used in this, and succeeding figures is in order at this point. The geographical region, as designated by the X and Y axis of the plot, are in kilometers and, for the plot of Figure 3, the radio signal strength resulting from the Cottonport transmitter (operating at 37.86 MHz) to a hypothetical mobile unit is calculated at each 10 kilometer grid. Note that boundary extremes of the southern portion of the VEC district are indicated by locating hypothetical mobile units at several of these extreme points; specifically at Sites 6, 7, 8, 9, 12, and 13. This locating procedure allows for easy identification of maximum distances. Note also that at each 10 kilometer grid there is a diamond shaped symbol (at least for those locations not too distant from the Cottonport tower). If the diagonal measure of a diamond is twice the measure of an arm of its internal cross, then the probability of a "good" signal at that location approaches 100%; under these conditions, adjacent diamonds will touch at the corners. If the probability for a good signal is 50%, then the diagonal measure of the diamond will equal that of its internal cross. As an example, a near 100% probability exists at location -10, -10, whereas at -10, -40 the probability for a good signal is about 50%.

Notice from Figure 3, that radio coverage in the extreme areas within the southern area (i.e. at Sites 7, 8, 12, and 13) is less than adequate, thus concurring with information obtained from VEC personnel. A minimum solution to the coverage problem within the Southern portion of the district would be installation of a better 37.86 MHz antenna at the Cottonport facility. At present, the existing antenna is omni-directional and has 0dB gain. An alternative would be to install an antenna such as the Decibel Products, model DB-212 (antenna data is provided in Appendix D) in place of the existing DB-201. The DB-212 does require additional tower space, however, and as a result may not be compatible with the existing tower, particularly in view of the fact that this tower belongs to TVA and currently serves their microwave link needs. In addition, even if the smallest DB-212 series is used (i.e. two elements), the minimum recommended tower height is 100 to 110 feet (as noted in the manufacturer's data). Use of the 90 foot tower would, therefore, likely result in some compromise in antenna performance. In addition, as can be seen from the data sheet the number of tower legs, tower face dimensions and tower orientation are also important factors. If, however, it is possible to effectively utilize the existing

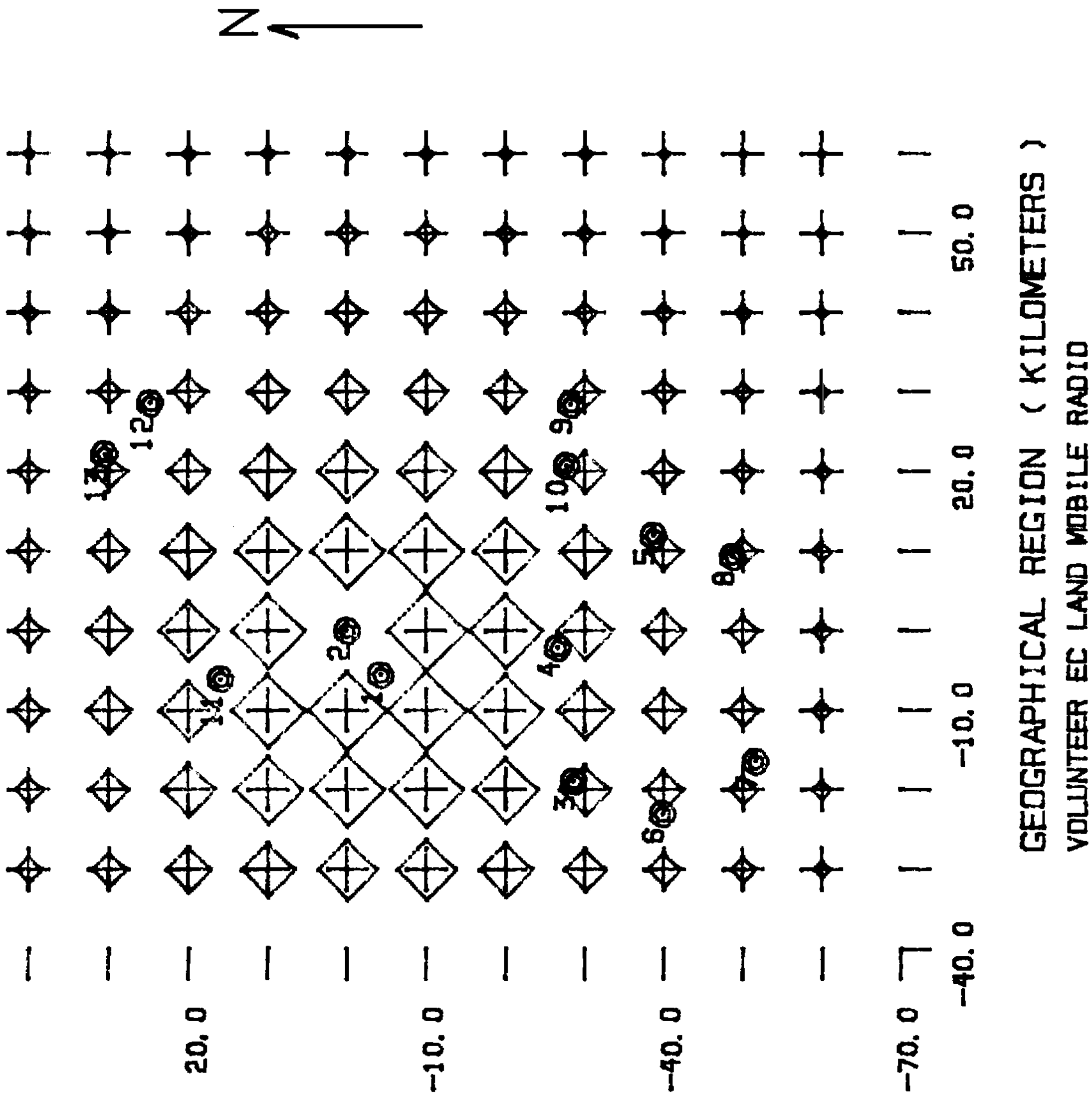


Figure 3. Calculated Radio Coverage from Cottonport-
Present Configuration

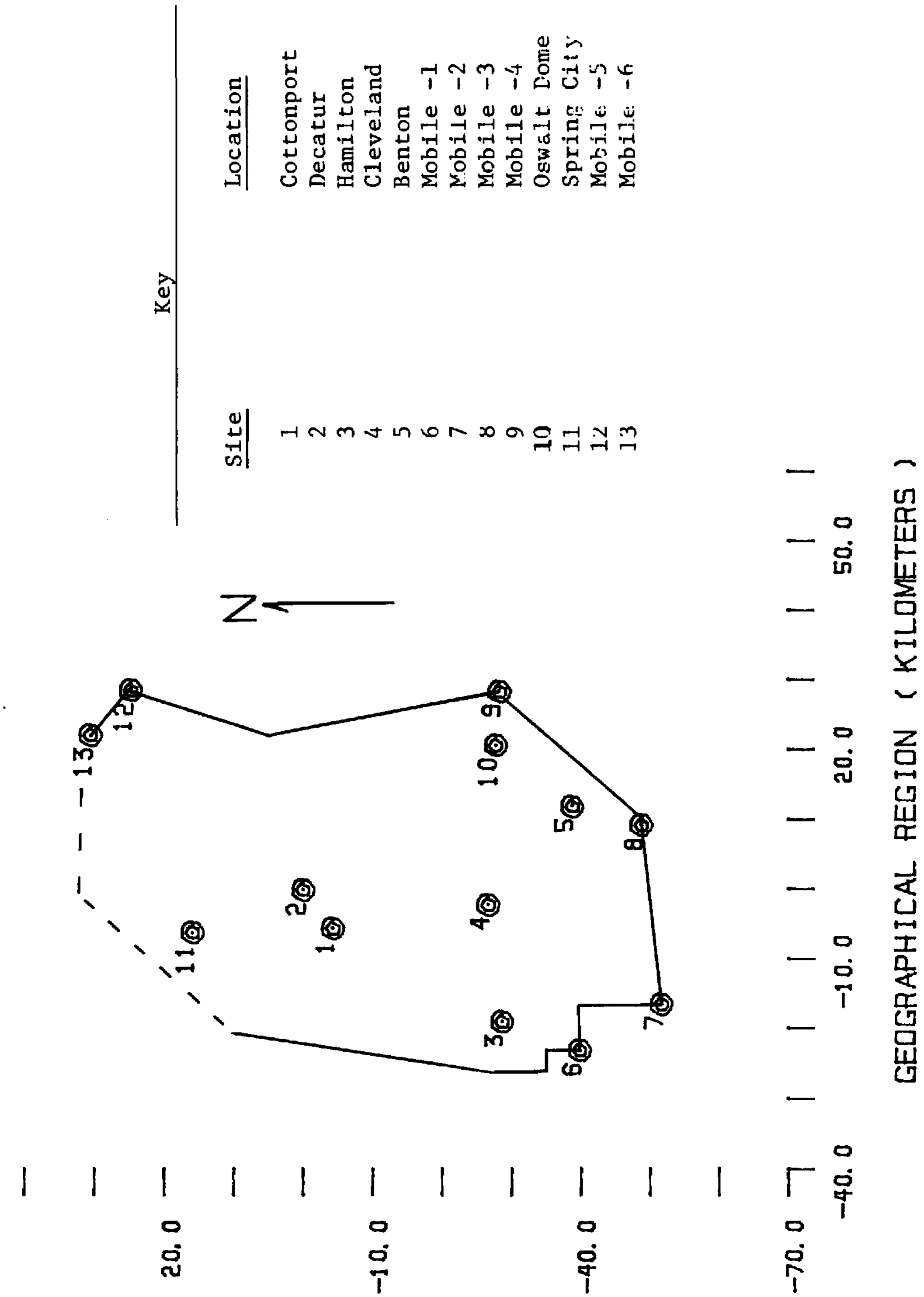


Figure 4. Geographical Depiction of Southern District

tower, then a radio coverage profile approximating that of Figure 5 can be expected.

A preferred approach for the Cottonport facility would be installation of a new tower, having a location quite close to the present microwave tower in order that existing AC power could be easily routed to this new location. If a 200 foot, guyed tower were located at Cottonport (at a tower cost of about $8,500) and was equipped with a DB-212-3 antenna (i.e. 3 elements), the radio coverage would then improve to the profile illustrated in Figure 6, or essentially solid coverage.

It is important to emphasize that mathematical computation of radio coverage profiles are statistical in nature and as a result various factors, such as interference from co-channel users or severe "radio shadowing," for example, can degrade expected performance. To overcome such potential problems, radio network planning should maximize coverage probability, within reasonable and legal limits, to ensure against "dead zones." Of particular concern for the VEC area is the fact that Cottonport is near the western boundary of the area, and since the mountains run in a north-south direction, it is possible for a mobile unit to be within a significant radio shadow for transmissions to and from Cottonport. In addition, Cottonport is only 200 to 400 feet above average terrain. A higher elevation above average terrain would provide more reliable coverage under various radio conditions.

Oswalt Dome Because Cottonport is only 200-400 feet above average terrain, topographical maps of the area were investigated to determine if a more suitable location for placement of a radio relay exists. As a result of this investigation, it was noted that Oswalt Dome on the eastern boundary is considerably better than Cottonport in regard to elevation. Cottonport is 1100 feet MSL whereas Oswalt Dome is at 3000 feet MSL; a 1900 foot difference. According to the topographical map, a microwave tower already exists at Oswalt Dome, thus AC power for operation of VEC equipment should be readily available.

If the VEC repeater were located on Oswalt Dome, other mountains within the Southern area may still result in some "radio shadowing." However, these mountains have typical elevations such as: Sand Mountain at 1100 feet, Prince Knob on Little Mountain at 1500 feet, and Todd Mountain at 1000 feet, this in contrast to Oswalt Dome with its elevation of 3000 feet MSL. Also, these same mountains already result in significant radio shadowing with the repeater in its present location at Cottonport.

Because of the apparent attractiveness of the Oswalt Dome location, radio coverage calculations were performed, assuming a repeater at this specific location. Figure 7 presents the results of these calculations. During the course of making these calculations several different system parameters were utilized. Specific assumptions included: (1) placement of a OdB gain antenna on a 100 foot tower, (2) a DB-212-3 antenna on a 200 foot tower and, (3) a 300 watt transmitter versus 100 watts in conjunction with various tower heights and antennas. In each case, the calculations showed complete coverage of the Southern area. Considering overall cost and system effectiveness, a preferred configuration would likely be a DB-212-3 antenna on a 200 foot guyed tower, and a 100 watt transmitter. Use of a 300 watt transmitter is also a possibility, but would appear to be unnecessary for

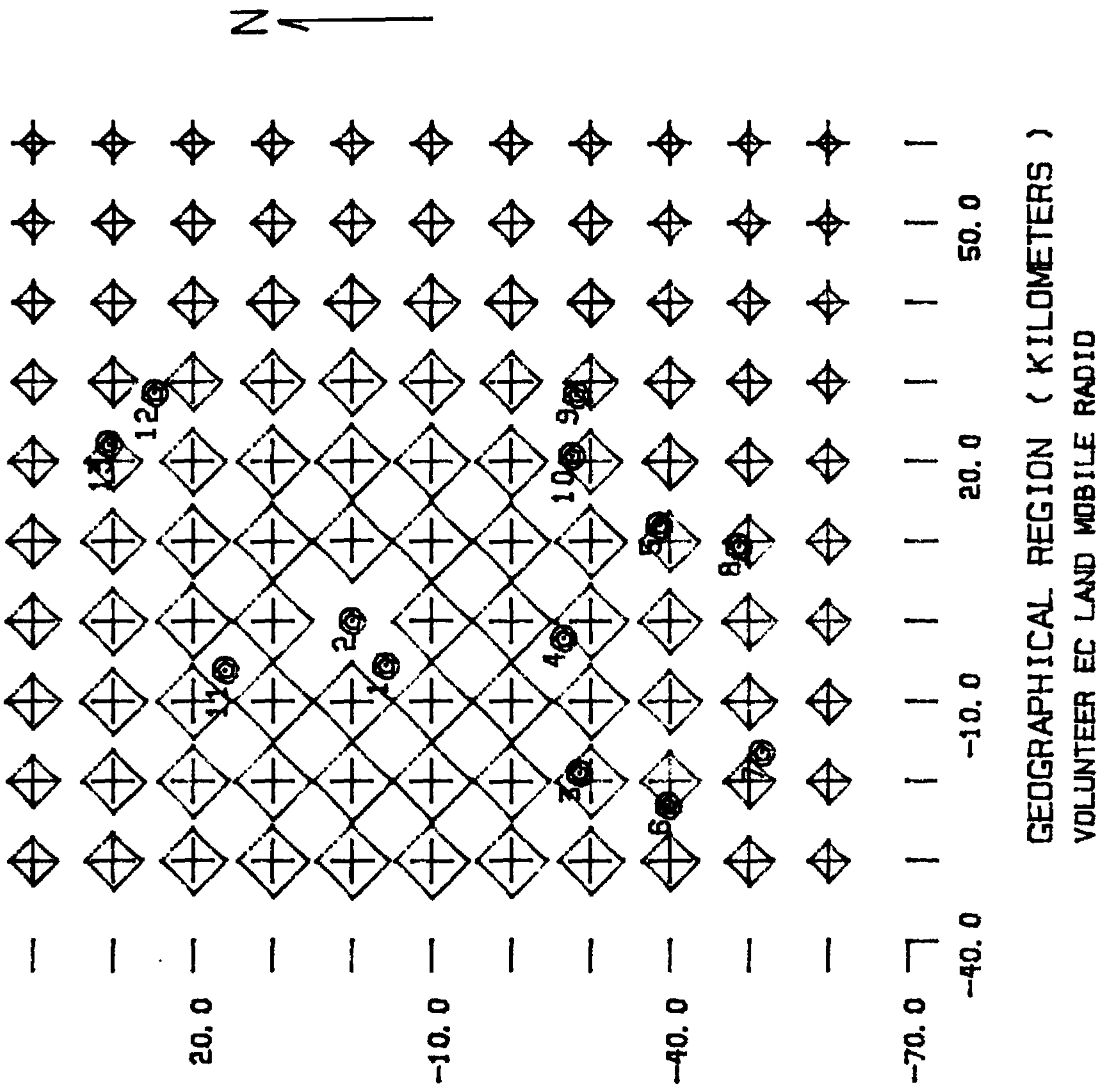


Figure 5. Calculated Radio Coverage from Cottonport Present Tower - Improved Antenna

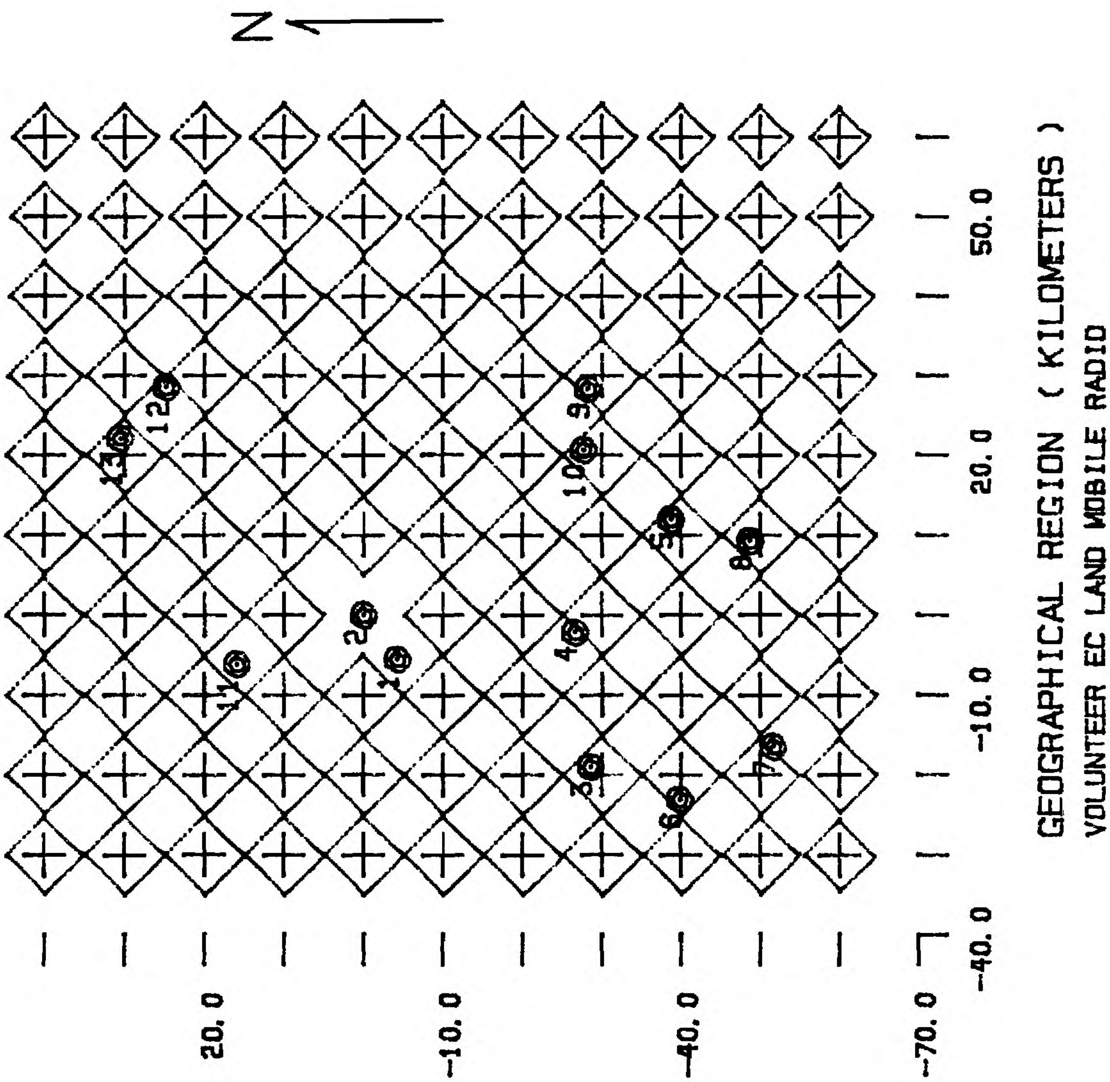


Figure 6. Calculated Radio Coverage from Cottonport - Improved Antenna System

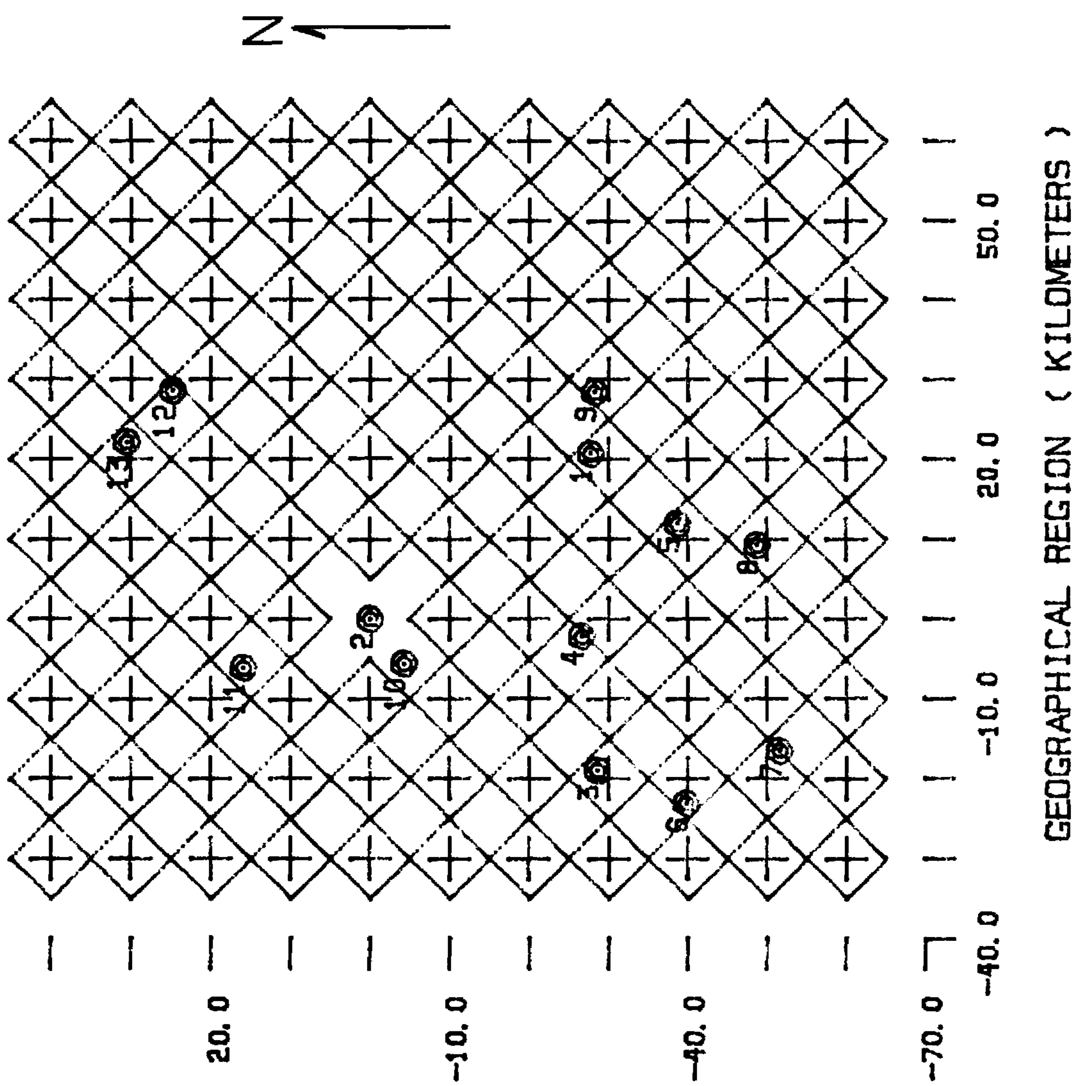


Figure 7. Calculated Radio Coverage from Oswalt Dome

this location.

Georgetown/Ten Mile An alternative to having the repeater located either at Cottonport or at Oswalt Dome would be to locate repeaters at two or more points within the Southern district and at locations where VEC facilities currently exist. An example of such an approach would be to locate one repeater at the Georgetown substation and a second repeater at the Ten Mile substation.

Assuming placement of such repeaters at Georgetown and at Ten Mile substations, several radio coverage calculations were performed. Each location was analyzed separately and considered for two different conditions: (1) a 200 foot tower having a 0dB gain antenna, and (2) the same 200 foot tower but with a DB-212-3 antenna providing 4dB gain with an omnidirectional pattern. Figure 8 illustrates the calculated radio coverage from the Georgetown repeater site utilizing a 0dB, omni-directional antenna on a 200 foot tower. Figure 9 illustrates the improvement attained by use of the DB-212-3 antenna. In a similar manner, Figure 10 illustrates the calculated coverage from the Ten Mile location with a 0dB gain antenna on a 200 foot tower; Figure 11 is the calculated coverage when the 0dB antenna is replaced with the DB-212-3. Overlaying either Figures 8 and 10 or Figures 9 and 11 will indicate radio coverage over the entire southern area.

There are, however, at least five major factors to be considered in regard to locating radio repeaters at these two substations or at other similar locations. First, a guyed tower requires considerable land area; land which may or may not be readily available at the substation. For example, a 200 foot guyed tower requires a total area of some 2.8 acres. Second, the substations are not on mountains or ridges but in the valleys which significantly reduces effective antenna height. Third, ambient radio noise at, or near, the substation may adversely effect receiver performance. Fourth, with two or more repeaters, either tone-activated signaling or separate radio frequencies would be required in order that only one repeater would be activated for a given transmission. Fifth, considerable radio shadowing could be expected for this configuration, shadowing which cannot be totally accounted for in the calculations. As a result, north-to-south land mobile coverage would likely be very good since the mountains run in a north-south direction. However, east-to-west coverage may be marginal in some areas.

Overall there is no real substitute for placing an antenna at the highest point within the geographical area to be covered.

3.1.2 Special Areas

Benton Radio coverage from the Benton office was considered separately because of their current operating procedure, specifically, in a somewhat independent manner, covering the southeastern corner of the VEC district. The major land-mobile coverage problems are south along Highway 64 and east over Chilhowee Mountain; the mountain which includes Oswalt Dome.

Radio coverage calculations were first performed utilizing the existing equipment configuration at Benton, i.e. a 0dB gain, omni-directional antenna mounted on a 50 foot pole. The results of these calculations are presented

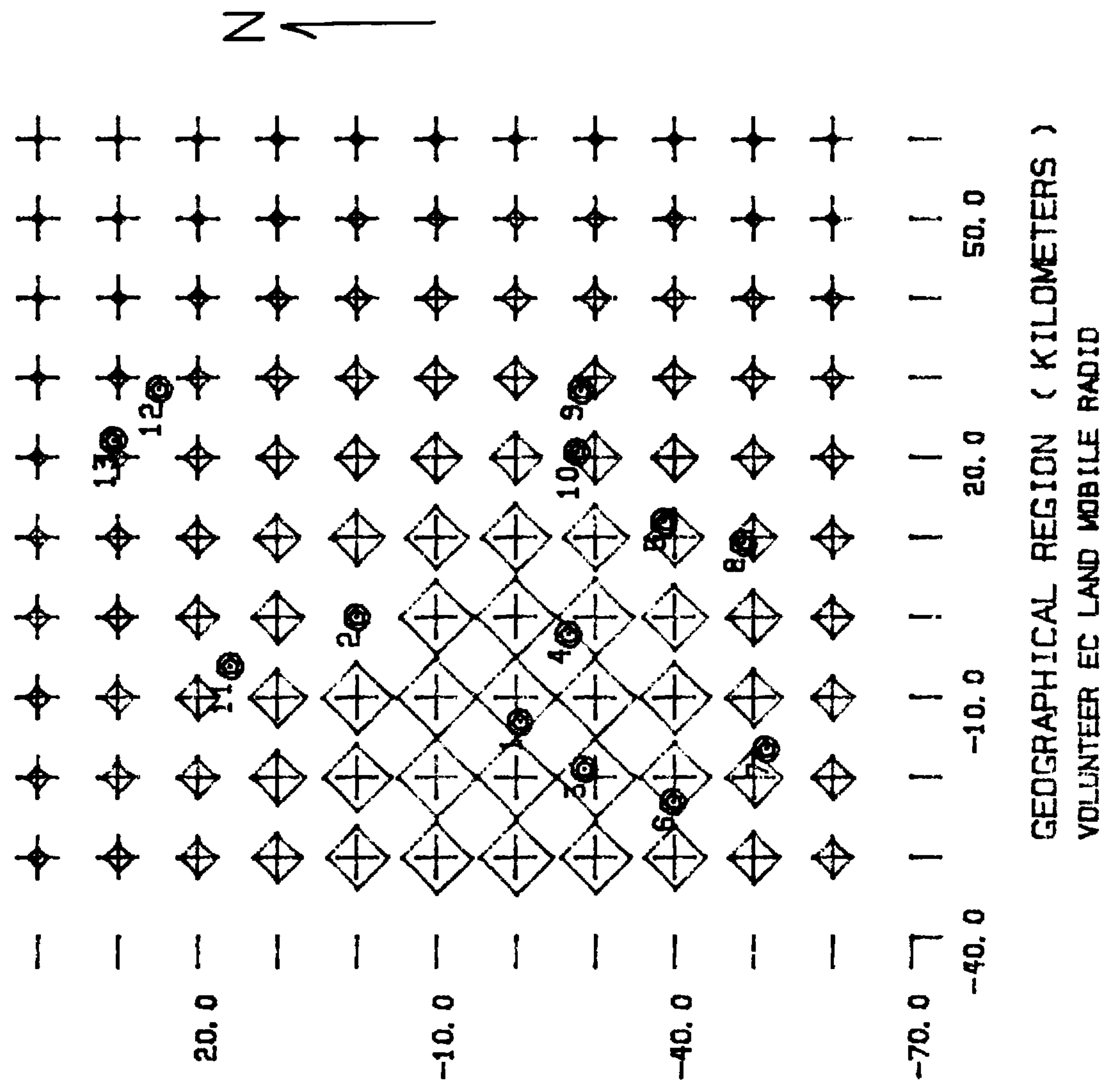


Figure 8. Calculated Radio Coverage from Georgetown - OdB Gain Antenna

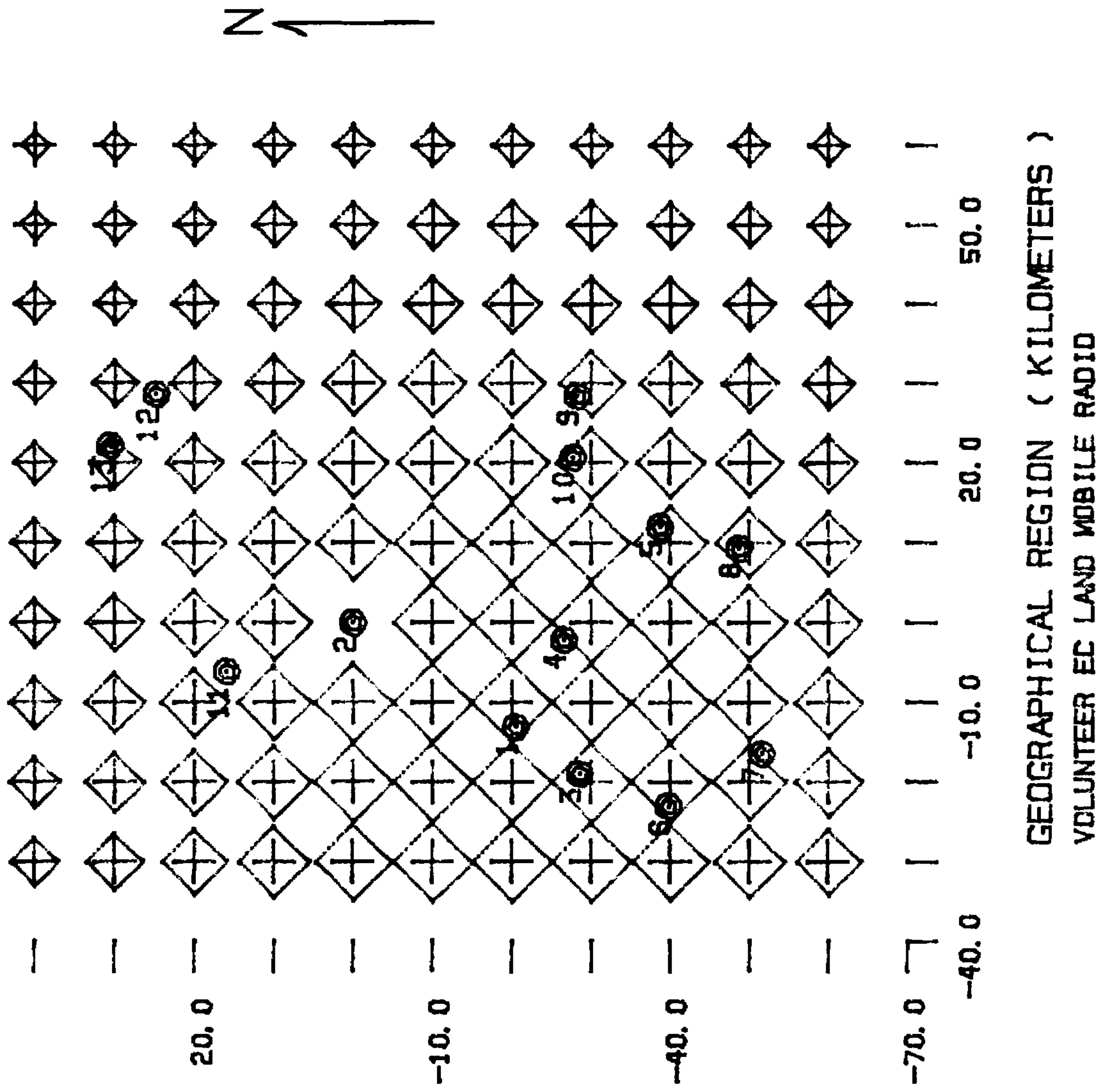


Figure 9. Calculated Radio Coverage from Georgetown - 5dB Gain Antenna

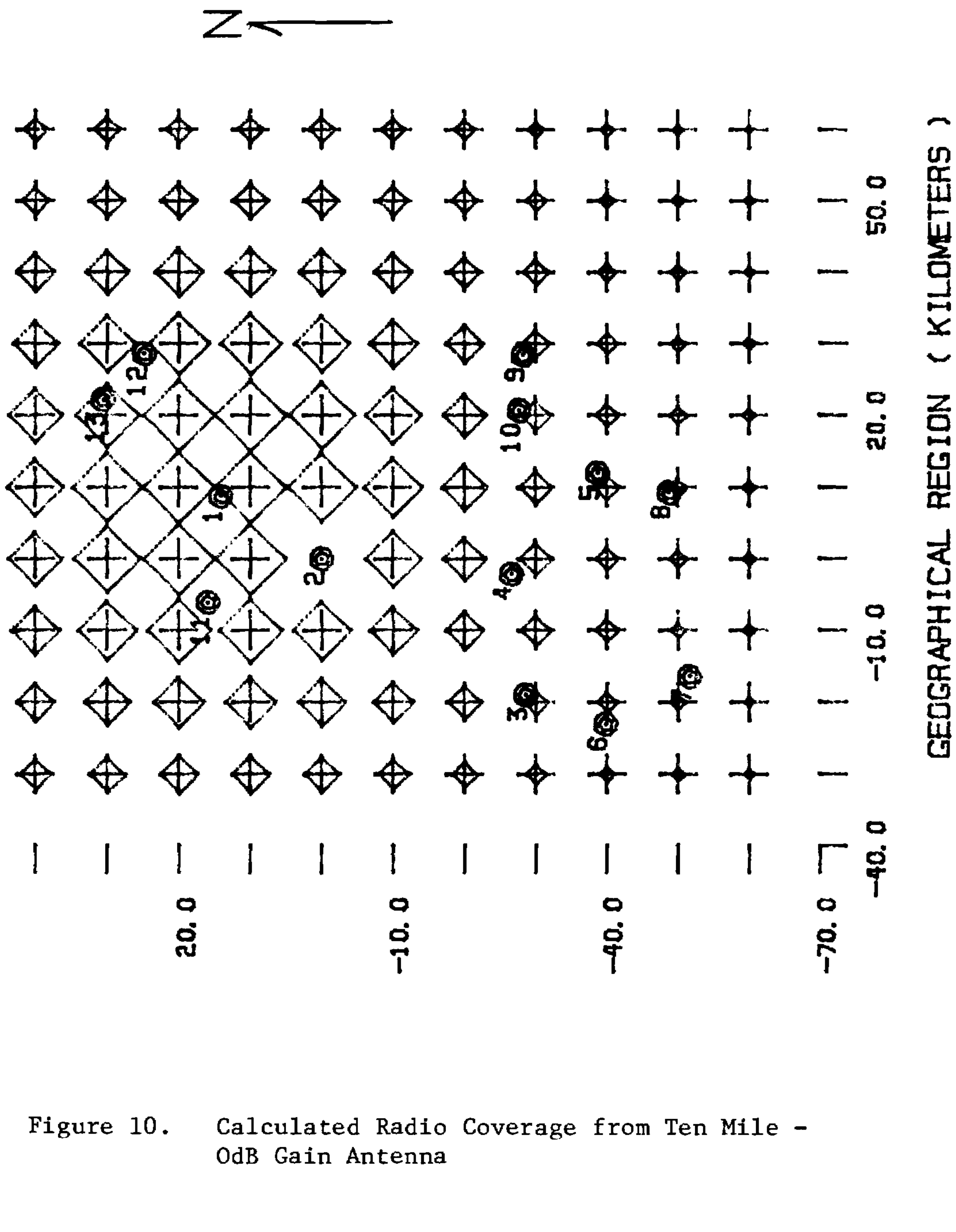


Figure 10. Calculated Radio Coverage from Ten Mile - OdB Gain Antenna

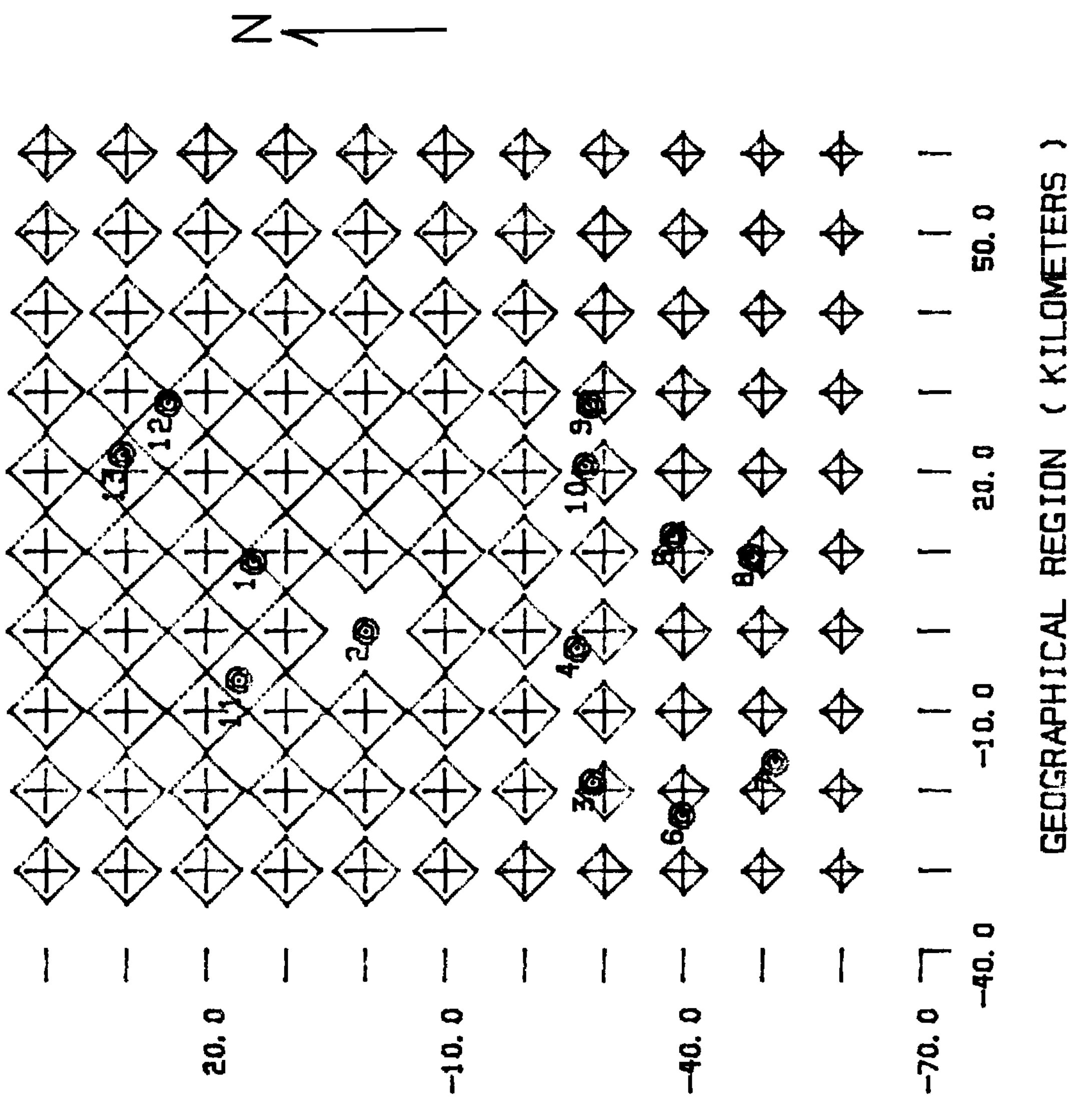


Figure 11. Calculated Radio Coverage from Ten Mile - 5dB Gain Antenna

in Figure 12. Very limited radio coverage is apparent from this calculation and is in agreement with information obtained from VEC personnel. In an attempt to significantly improve the current situation it was assumed that the existing antenna system was replaced with a DB-212-3 antenna and mounted on a 200 foot guyed tower. The results of this new configuration are illustrated in Figure 13, and, as would be expected, considerable improvement is achieved. It is likely that this improved antenna system would solve the land-mobile coverage problems that currently exists along Highway 64 to the south. However, to the east across Chilhowee Mountain, adequate coverage problems may still exist because of the height of this mountain and its proximity to Benton. Again, the calculations are statistical in nature and as a result do not totally account for such special situations as Chilhowee Mountain and its proximity to Benton.

Spring City At Spring City, a situation similar to Benton exists in that Spring City (because of its geographical location) operates somewhat independently. At Spring City the land-mobile coverage is also less than satisfactory, with the major problem being north-south coverage through the valley region; i.e., north to Roddy and south to Evensville. In a comparison between Spring City and Benton, the major difference is that at Benton there is a need to "talk over" the mountains, whereas at Spring City the primary area of interest is in a north-south direction through the valley region. This latter situation is a less difficult problem.

Figure 14 presents the results of radio coverage calculations for the existing situation at Spring City. Again, primarily because of the present low antenna height, limited coverage is apparent and is in general agreement with information obtained from VEC personnel. Increasing the antenna height through use of a 200 foot guyed tower and replacing the OdB, omni-directional antenna with a DB-212-3, (configured for omni coverage) results in the calculated radio coverage illustrated in Figure 15.

3.2 General Considerations - Northern Area

Based on information obatined from VEC personnel, land-mobile radio coverage is reported to be less of a problem in the northern area of the VEC geographical region which, as mentioned earlier, is likely due in large measure to the lower population density and associated power distribution system. Again, the potential for land-mobile radio coverage problems is greater in this northern region because of the mountains and should the region experience a significant growth at some future time, these radio coverage problems would likely become very evident.

A general problem which appears to exist within the northern region is that of co-channel interference. Originally, land-mobile services within the northern region were on Channel 1 (37.86 MHz) but were transferred to Channel 2 (37.58 MHz) because of serious co-channel interference. Interference conditions on Channel 2, although less severe than was the case for Channel 1, is still an area of major concern.

There exists two basic methods for overcoming, or circumventing, co-channel interference. First, is obviously to change the operating frequency to another channel; i.e. VEC move to another channel or the interfering station(s) move to another channel. Obtaining a new frequency

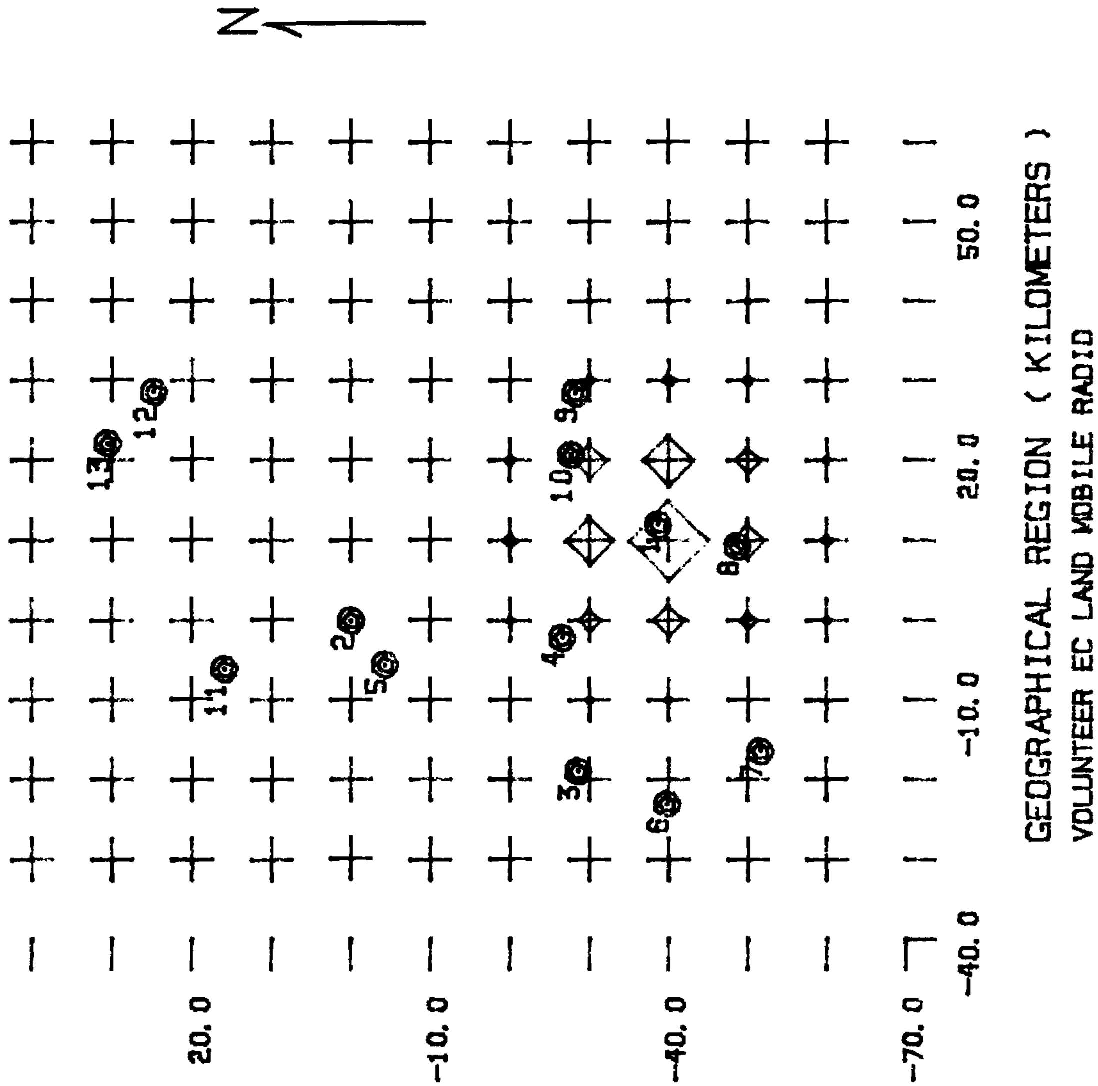


Figure 12. Calculated Radio Coverage from Benton - Present Configuration

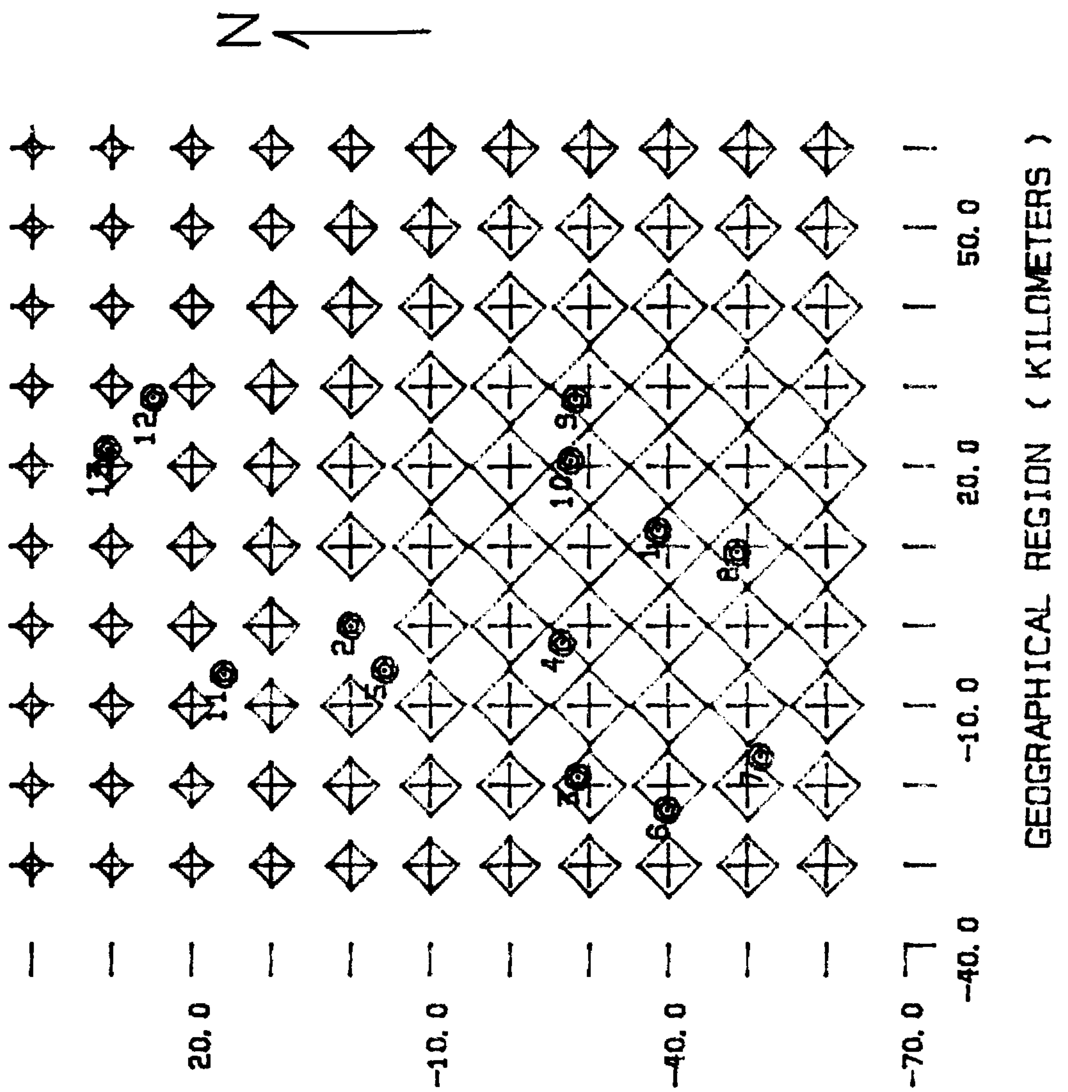


Figure 13. Calculated Radio Coverage from Benton - Improved Antenna System

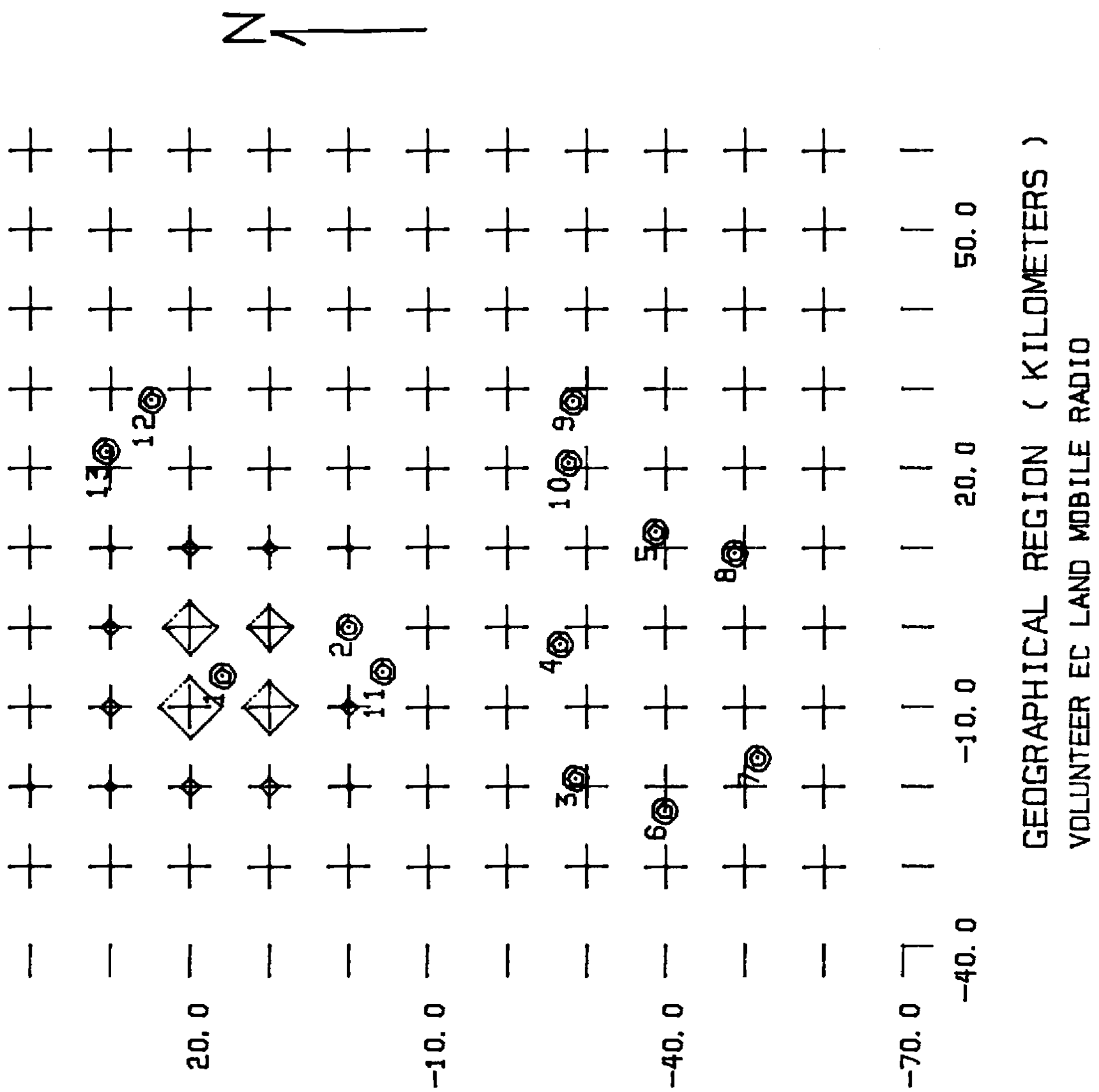


Figure 14. Calculated Radio Coverage from Spring City - Present Configuration

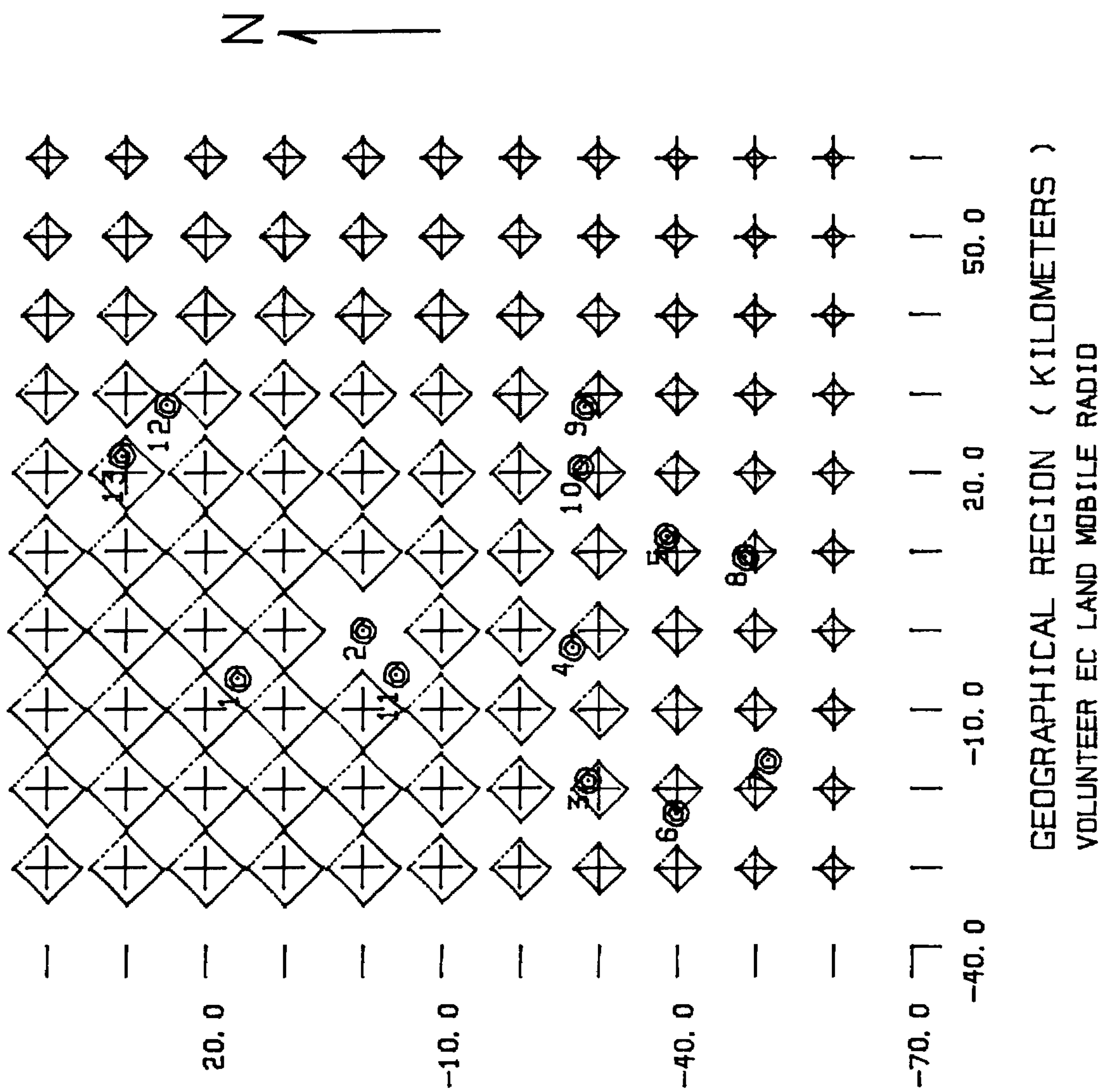


Figure 15. Calculated Radio Coverage from Spring City - Improved Antenna System

assignment, however, is not always an easily achieved solution because of the extremely crowded nature of the radio spectrum. Second, is to improve the existing radio system in such a manner as to provide stronger signals at all desired locations in order to "swamp-out" the undesired co-channel signals. Providing stronger signals can be accomplished through use of such techniques as (1) increased transmitter power, (2) improved antenna system (particularly the use of directional antennas where practical) and (3) implementation of a radio relay system.

Specific recommendations are presented in Section 4 of this report.

3.2.1 Special Areas

Within the northern region, only Crossville and the surrounding area was analyzed as a special case. The situation at Crossville is similar to conditions at Spring City in that limited land-mobile radio coverage currently exist because of an antenna height of only 70 feet in association with the mountainous terrain.

Radio coverage calculations with the existing system are presented graphically in Figure 16; limited radio coverage is again evident. In this figure Site #1 is Crossville, Site #2 is Monterey, Site #3 is Jamestown, and Site #4 is Byrdstown. As with the previous calculation for Benton and Spring City, an increase in antenna height and use of a higher gain antenna (4dB vs. 0dB) results in a significant improvement as evidenced by the results plotted in Figure 17.

4.0 Recommendations

4.1 Centralized Dispatching

Centralized dispatching was not evaluated thoroughly due to the limited scope of this project. However, based on the VEC survey, there is a strong need for Centralized Dispatching. If centralized dispatching is implemented, the need for a better and more reliable communication system is a must. Also, some consideration should be given to forming two "Centralized Dispatching" points, one in the Southern region and the other in the Northern region. Due to the geographical differences between the two areas, the Decatur office could serve as the central point in the southern district and either Crossville or possibly Monterey as the second central point.

Decatur appears to be the better equipped to handle centralized dispatching at present. There are dedicated telephone lines between each district office and sub-office. These telephone lines are not used after normal working hours and therefore could possibly be used for centralized dispatching. However, this would be based upon an improved communication system, in accordance with this report. Further study and analyses are recommended for this area.

4.2 Supervisory Control

Supervisory control was considered only briefly due to the limited scope of this effort. However, based on the above analysis of VEC's land-mobile

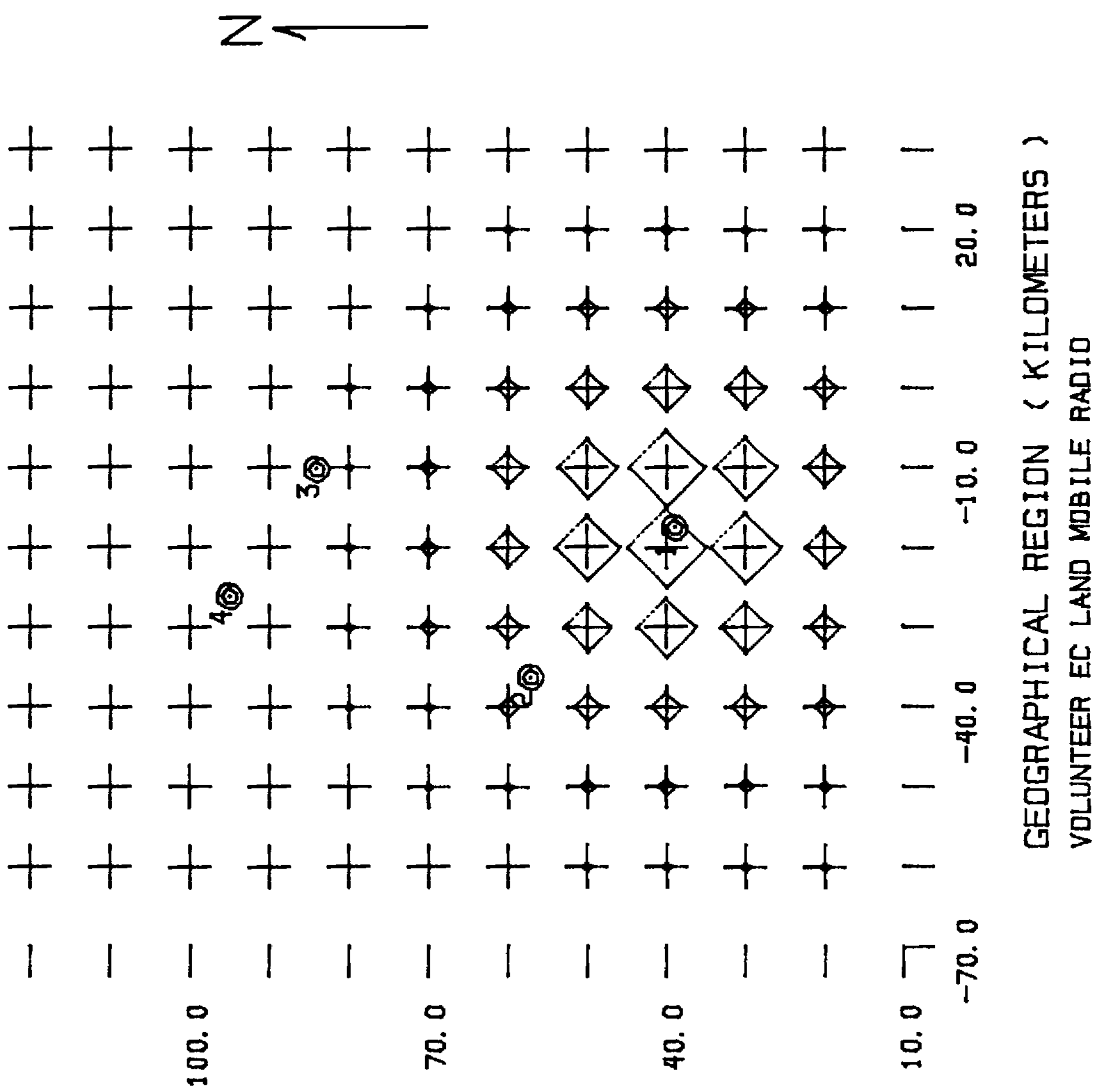


Figure 16. Calculated Radio Coverage from Crossville - Present Configuration

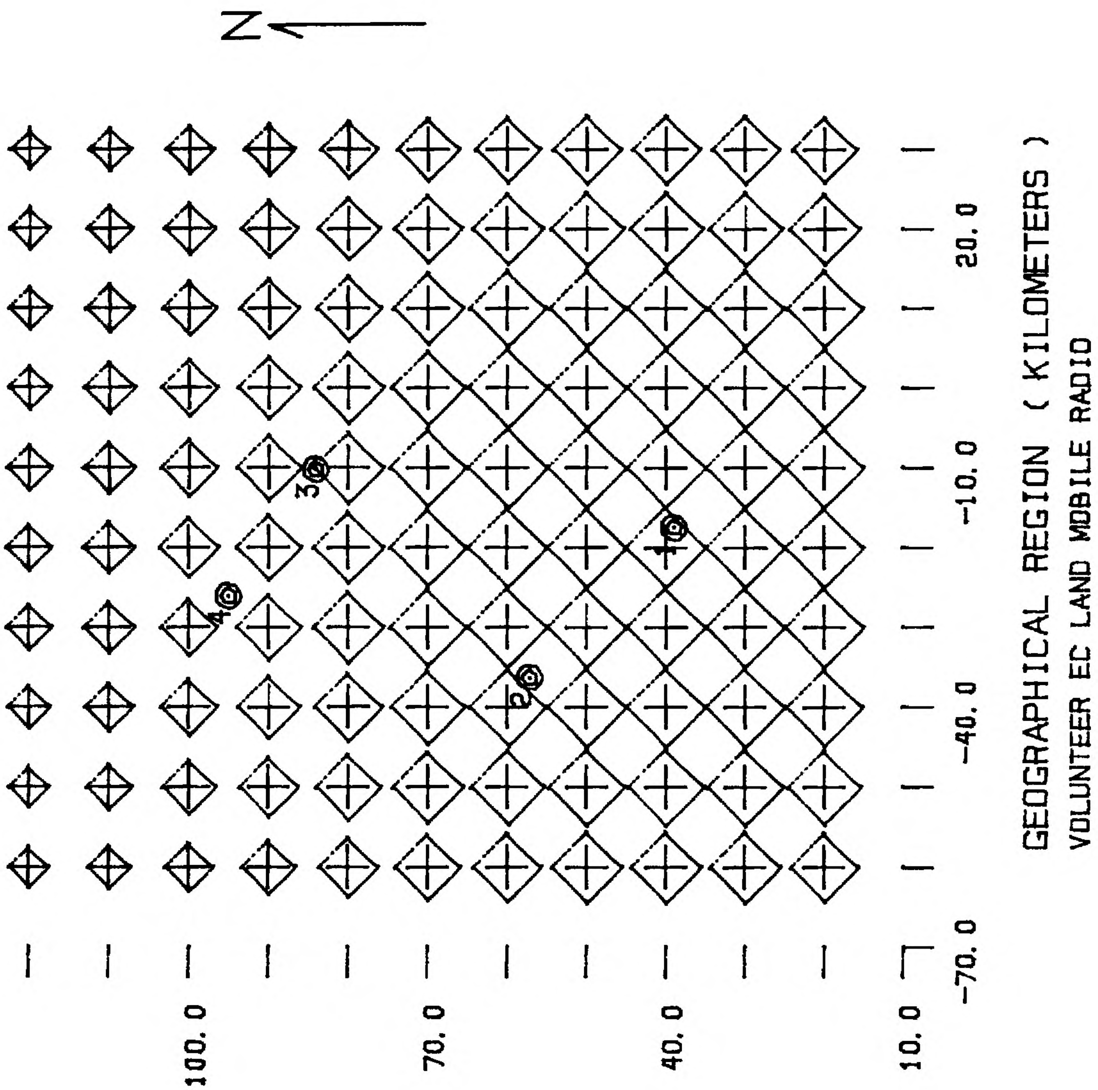


Figure 17. Calculated Radio Coverage from Crossville - Improved Antenna System

communication system, several points can be made. First, if a radio signaling, supervisory control system is implemented, then installation of new and higher towers for the land-mobile service can become an inherent and useful part of a supervisory control system as well. Second, either ripple, power line carrier or a hybrid system (e.g. ripple/radio), should also be considered, although due to the large geographical area covered by VEC, approaches which utilize ripple or power line carrier may not be practical. Third, it may be advantageous to operate a VEC supervisory control system as separate North and South units.

As future plans are formulated for implementation of a supervisory control system, additional study and evaluation would be required. This evaluation would likely be influenced by the current status of the land-mobile radio system and in particular the location and height of the towers.

4.3 Land-Mobile Communications

Based on the analysis of Section 3, a number of specific comments and recommendations can be made regarding needed improvements to VEC land-mobile radio services.

(1) Throughout the entire VEC system, a significant improvement in radio coverage could be achieved through installation of higher towers with improved antennas (i.e. higher gain). If long term plans call for a microwave system, then free-standing, rigid towers should be considered rather than guyed towers. The cost of a free-standing, rigid tower will be approximately five-times that of the same height guyed tower (assuming 200 feet).

(2) Within the Southern region, relocation of the current radio relay from Cottonport to Oswalt Dome is preferred over modification to existing facilities at Cottonport.

(3) If use of the Cottonport facility is to be continued, a complete facility checkout should be accomplished in an attempt to clear the problem of nearby thunderstorms and/or electostactic buildup which currently degrades radio relay performance. Check all cables and connectors for corrosion, breaks, etc. and also check for proper grounding of the tower and all equipment. In addition, the standby generator at Cottonport should be serviced and maintained to prevent radio system failure during AC power outages.

(4) For the Northern area, attempt to determine the source and location of the co-channel interference and then, where practical, use directional antennas on increased height towers for improved system performance.

(5) For the Northern area, if (4) above is not feasible, perform a frequency assignment search through the Utilities

Telecommunication Commission (UTC) to determine if another frequency is available which may be less subject to co-channel interference. It should be understood, however, that even if a new frequency is found and that frequency does indeed have less co-channel interference, there is no assurance that this satisfactory condition would continue indefinitely since new users could be assigned to this frequency at a later date.

(6) Considerations should be given to providing improved mobile-to-mobile coverage through use of a radio repeater system. However, under FCC regulations, mobile-to-mobile is not permitted either at low or high band VHF. As a result, the present VEC land-mobile radio system cannot be adapted to a repeater concept; a completely new UHF system would be required. Going to this higher frequency would require a rather extensive relay system since the higher frequencies will not propagate within the mountainous terrain as well as the currently-used, low band VHF. Cost factors would be a major consideration.

4.4 Data processing

The single problem that was noted during the VEC survey with data processing was the slow response time during peak usage of the computer by other VEC offices when meter readings were entered into the computer system. This problem could possibly be eliminated by providing the meter reader with a small, hand-held punch card system or with a magnetic tape recorder for entering data as each meter is read. Utilizing such a method would permit meter readings to be quickly read into the computer for eventual processing, as compared with the present method of transcribing from handwritten entries.

Also, the computer system is used primarily for general bookkeeping and accounting purposes. Depending upon the limitation of the computer, its usage should be expanded to include such items as calculating real time peak demand loads, inventory control, and such engineering calculations as peak current demands in a particular feed line, etc.

Additional study would be needed in this area to determine the full usage of the existing data processing system.

4.5 Load Management

Implementation of a full load management system within VEC could present some difficult problems because of the mountainous terrain; the problems being particularly acute if some of the customers to be load controlled, are at significant distances from the load management transmitter. A major source of the problem lies in the fact that the load management receivers (or switches) would be mounted on the customer's air conditioner, for example, with the antenna consisting of a simple loop of wire within the receiver. Because the receiver antenna is only a simple loop and is typically some three-to-six feet above the gound, reliable reception of the load management signal is accomplished only by ensuring a relatively strong signal within the general area.

One method used to overcome the "inadequate antenna" problem is to mount the load management radio receiver (along with an improved antenna) on a nearby existing power pole, then take the radio baseband output signal and transmit, via power line carrier, the 100 or so feet to the customer's baseband receiver. This approach is economically feasible only if several customers can be served from a single pole-mounted receiver, e.g. a cluster of homes all within several hundred feet of the pole-mounted receiver.

If a proposed VEC load management system is intended to only serve customers in, or near, one of the towns such as Decatur, Benton or Spring City, the problems become less difficult because of the shorter transmitter-to-receiver distances involved. Load controlling only customers within the towns may be the preferred approach for VEC, particularly if this approach would serve the majority of customers; a normal objective of a load management system.

Again, if the 200 foot towers are installed for the land-mobile communications system these same towers could likely be shared with a load management system.

APPENDIX A

VEC Telephone System

DECATUR TELEPHONE SYSTEM SUMMARY

A. Telephone System

1. South Central Bell
2. Leased

B. Number of Leased Lines 2/12 trunk

C. Number of WATS Lines

1. Two inward
2. Two outward

D. Type of System

1. Dimension

E. Special Features from Switchboard

1. Attendant control of trunk group access
2. Busy verification of station lines
3. Call forwarding
4. Direct trunk group selection
5. Foreign exchange (FX) service
6. Incoming calls
7. Incoming call identification display
8. Intercept calls
9. Lamp test
10. Loudspeaker paging
11. Night service
12. Originated call by attendant
13. Outgoing calls
14. Power failure transfer
15. Privacy and lockout
16. Splitting - calling party only
17. Tie trunk access
18. Timed reminder
19. Trunk answer from any station
20. Trunk group indicators
21. Trunk to trunk connections
22. Trunk verification by customer
23. Two party hold
24. WATS service

F. Number of Telephones - 43

G. Special features
   1. Automatic callback - calling
   2. Automatic identified outward dialing (AIOD)
   3. Call forwarding
   4. Call hold
   5. Call pickup
   6. Call waiting
   7. Code restriction
   8. Direct outward dialing
   9. Distinctive ringing
   10. Line lockout with warning
   11. Loudspeaker paging
   12. Outgoing trunk queuing
   13. Three way conference transfer
   14. Trunk answer from any station

H. Overall Telephone Communication Quality Good

I. Average monthly cost

   1. Leased lines $592.81
   2. WATS lines
      a. inward $112.46
      b. outward $115.85

GEORGETOWN TELEPHONE SYSTEM SUMMARY

A. Telephone System

   1. South Central Bell
   2. Leased

B. Number of Leased Lines 2

C. Number of WATS Lines 0

D. Type of System

   1. Key system

E. Number of Telephones

F. Special Features

   1. Hold
   2. Direct dial

G. Overall Telephone Communication Good

H. Average Monthly Cost $104.96

BENTON TELEPHONE SYSTEM SUMMARY

A. Telephone System

1. South Central Bell
2. Leased

B. Number of Leased Lines 2

C. Number of WATS Lines 0

D. Type of System

1. Key system

E. Number of Telephones 4

F. Special Features

1. Direct dial
2. Hold

G. Overall Telephone Communication Quality Good

H. Average Monthly Cost $86.40

CLEVELAND TELEPHONE SYSTEM SUMMARY

A. Telephone System

   1. South Central Bell
   2. Leased

B. Number of Leased Lines 3

C. Number of WATS Lines 0

D. Type of System

   1. Key system

E. Number of Telephones

F. Special Features

   1. Hold
   2. Direct dial
   3. Transfer
   4. Paging

G. Overall Telephone Communication Quality Good

H. Average Monthly Cost $499.43

MONTEREY TELEPHONE SYSTEM SUMMARY

A. Telephone System

   1. General Telephone
   2. Leased

B. Number of Leased lines 3

C. Number of WATS Lines 0

D. Type of System

   1. Key system

E. Number of Telephones 5

F. Special Features

   1. Hold
   2. Direct dial

G. Overall Telephone Communication Quality Poor

H. Average Monthly Cost $133.50

I. Number of beepers 3

JAMESTOWN TELEPHONE SYSTEM SUMMARY

A. Telephone System

   1. Twin Lakes
   2. Leased

B. Number of Leased Lines 2

C. Number of WATS Lines 0

D. Type of System

   1. Key system

E. Number of Telephones 5

F. Special Features

   1. Hold
   2. Direct dial

G. Overall Telephone Communication Fair

H. Average Monthly Cost $109.76

BYRDSTOWN TELEPHONE SYSTEM SUMMARY

A. Telephone System

   1. Twin Lakes
   2. Leased

B. Number of Leased Lines 2

C. Number of WATS Lines 0

D. Type of System

   1. Key system

E. Number of Telephones 2

F. Special Features

   1. Direct dial

G. Overall Telephone Communication Quality Fair

H. Average Monthly Cost $70.75

SPRING CITY TELEPHONE SYSTEM SUMMARY

A. Telephone System

  1. South Central Bell
  2. Leased

B. Number of Leased Lines 2

C. Number of WATS Lines 1

D. Type of System

  1. Key system

E. Number of Telephones 4

F. Special Features

  1. Hold
  2. Direct dial

G. Overall telephone Communication Quality Good

H. Average Monthly Cost $213.85

CROSSVILLE TELEPHONE SYSTEM SUMMARY

A. Telephone System

   1. General Telephone
   2. Leased

B. Number of Leased Lines 3

C. Number of WATS Lines 0

D. Type of System

   1. Key system

E. Number of Telephones 6

F. Special Features

   1. Hold
   2. Direct dial
   3. Transfer

G. Overall Telephone Communication Quality Good

H. Average Monthly Cost $184.35

ANSWERING SERVICES

Crossville District

Sonitrol of Cumberland Tri-County, Inc.	$ 600.00

Cleveland District

Cherokee Answering Service	$1,800.00
Telepage of Tennessee, Inc.	1,356.00

Interoffice Courier Service

Seelbach and Company, Inc. (stops at each office daily)	$24,440.00

APPENDIX B

VEC Data Processing System

LEASED EQUIPMENT

EQUIPMENT AND DESCRIPTION	LOCATION	MO. RENTAL	MO. MAINT.	TOTAL
Verifying Int. Punch	Data Processing	$ 116.00	$ 64.00	$ 180.00
Printer 60 Cycle	Data Processing	56.00	32.00	88.00
Single Station Display	Data Processing	88.00	58.00	146.00
201 Modem	Data Processing	37.00	14.00	51.00
201 Modem	Data Processing	37.00	15.00	52.00
201 Modem	Data Processing	37.00	15.00	52.00
201 Modem	Data Processing	37.00	15.00	52.00
201 Modem	Data Processing	37.00	15.00	52.00
201 Modem	Data Processing	37.00	15.00	52.00
90/30 Processor 32K	Data Processing	1,285.00	411.00	1,696.00
Multiplexer Channel	Data Processing	221.00	52.00	273.00
Storage Expansion	Data Processing	268.00	51.00	319.00
Uniservo 10 Control	Data Processing	216.00	75.00	291.00
Disc Storage	Data Processing	391.00	100.00	491.00
Disc Storage	Data Processing	391.00	100.00	491.00
Disc Storage	Data Processing	391.00	100.00	491.00
Storage Protect	Data Processing	13.00		13.00
Intg. Disc Adapter	Data Processing	212.00	59.00	271.00
Storage Expansion 32K	Data Processing	235.00	46.00	281.00
Storage Expansion 32K	Data Processing	235.00	46.00	281.00
Storage Expansion 32K	Data Processing	220.00	37.00	257.00
Storage Expansion 32K	Data Processing	238.00	37.00	275.00
Storage Expansion 32K	Data Processing	468.00	70.00	538.00
Uniservo 10	Data Processing	201.00	71.00	272.00
Band Printer 900 LPM	Data Processing	816.00	262.00	1,078.00
Business 48 Character	Data Processing	26.00		26.00
Intg. Reader	Data Processing	162.00	70.00	232.00
Communication Adapter	Data Processing	166.00	41.00	207.00
Micro Login Expansion	Data Processing	81.00	19.00	100.00
Synchronous Line Ada.	Data Processing	16.00	7.00	23.00
Synchronous Line Ada.	Data Processing	16.00	7.00	23.00
Synchronous LIne Ada.	Data Processing	16.00	7.00	23.00
Synchronous LIne Ada.	Data Processing	16.00	7.00	23.00
Synchronous Line Ada.	Data Processing	16.00	7.00	23.00
Synchronous Line Ada.	Data Processing	16.00	7.00	23.00
Synchronous Line Ada.	Data Processing	16.00	7.00	23.00
Synchronous Line Ada.	Data Processing	16.00	7.00	23.00
Printer 60 Cycle	Decatur General Office	56.00	32.00	88.00
Single Station Display	Decatur General Office	80.00	58.00	138.00
Interface Parallel	Decatur General Office	8.00		8.00
Terminal Multiplexer	Decatur General and Decatur District Office	38.00	6.00	44.00
Printer 60 Cycle	Decatur District Office	50.00	32.00	82.00
Single Station Display	Decatur District Office	88.00	58.00	146.00
Interface Parallel	Decatur District Office	8.00		8.00

LEASED EQUPMENT

EQUIPMENT AND DESCRIPTION	LOCATION	MO. RENTAL	MO. MAINT.	TOTAL
Printer 60 Cycle	Spring City Sub-Office	50.00	32.00	82.00
Single Station Display	Spring City Sub-Office	88.00	58.00	146.00
201 Modem	Spring City Sub-Office	37.00	15.00	52.00
Printer 60 Cycle	Georgetown Sub-Office	56.00	31.00	87.00
Single Station Display	Georgetown Sub-Office	88.00	55.00	143.00
201 Modem	Georgetown Sub-Office	37.00	14.00	51.00
Printer 60 Cycle	Crossville District Office	50.00	32.00	82.00
Single Station Display	Crossville District Office	88.00	58.00	146.00
201 Modem	Crossville District Office	37.00	15.00	52.00
Printer 60 Cycle	Jamestown District Office	50.00	32.00	82.00
Single Station Display	Jamestown District Office	80.00	58.00	138.00
201 Modem	Jamestown District Office	37.00	15.00	52.00
Printer 60 Cycle	Byrdstown Sub-Office	56.00	28.00	84.00
Single Station Display	Byrdstown Sub-Office	88.00	50.00	138.00
201 Modem	Byrdstown Sub-Office	37.00	15.00	52.00
Printer 60 Cycle	Monterey District Office	50.00	32.00	82.00
Single Station Display	Monterey District Office	88.00	58.00	146.00
201 Modem	Monterey District Office	37.00	15.00	52.00
Printer 60 Cycle	Cleveland District Office	50.00	32.00	82.00
Single Station Display	Cleveland District Office	88.00	58.00	146.00
201 Modem	Cleveland District Office	28.00	14.00	42.00
Printer 60 Cycle	Benton Sub-Office	56.00	28.00	84.00
Single Station Display	Benton Sub-Office	88.00	50.00	138.00
201 Modem	Benton Sub-Office	28.00	14.00	42.00
		Monthly Total		$11,507.00

This does not include after hours special maintenance.

APPENDIX C

Regulatory Considerations - General Guidelines

REGULATORY CONSIDERATIONS - GENERAL GUIDELINES

The present form of radio communication for most of the electric cooperatives involves a base station and its associated mobile units. The regulatory basis for this mode of operation is Part 91, Subpart D, paragraph 91.151 which defines the conditions under which this type of operation may occur. In general, mobile-to-mobile and mobile-to-base communication is permitted as long as all parties have the <u>same</u> license, communication is essential to the efficient conduct of business, and no effort is made to render a common carrier service. The latter point is identified in Part 91, Subpart A, paragraph 91.2.

According to Part 91, Subpart D, paragraph 91.151, a station may communicate with any other station, without regard to type, service, or license, if the communication is directly related to safety of life or protection of property. This provides the means for station-to-station communication under <u>emergency conditions</u>, but this could not be used as the basis for routine station-to-station communications.

Provision has been made in the FCC's rules for routine communication through a single base station by mobile units of two or more licensees. This is the cooperative use described in Part 91, Subpart A, paragraph 91.6. Under this arrangement, two or more licensees may use and/or operate a common base station. This would mean that a mobile unit from one electric cooperative could communicate with the base station of another electric cooperative if the appropriate arrangements have been made. It is worth noting, however, that mobile-to-mobile communication is not specifically addressed in the description of cooperative use; and, therefore, it is difficult to determine if it would be permitted under this arrangement.

There are several other important features of the cooperative use arrangement that should be pointed out:

- All participating parties must be eligible for a license in the same industrial radio service.
- A person who is to receive service from a base station licensed to a person other than himself may obtain a license for his own units, or
- A person who is to furnish a base station service to mobile radio units installed in vehicles owned and operated by persons other than himself may be the licensee of these mobile radio units.

- The cooperative use arrangement may be without charge, or

- Contributions to capital and operating expenses may be accepted on a cost-sharing and non-profit basis, and the costs should be prorated on an equitable basis among all persons who are parties of the cooperative arrangement.

Additionally, there is the question of the frequency assignment for the various electric cooperatives participating in a cooperative use arrangement. The usual cooperative use arrangement allows two or more users in the same geographical area to use a single channel. This arrangement is attractive if and only if the users do not object to delays caused by several users sharing a single base station. The electric cooperatives, however, require the common channel operation on an infrequent basis, and would undoubtedly prefer a private channel of their own for their normal business. To accommodate both forms of operation, each electric cooperative would have to be licensed to operate on at least two frequencies: a common channel used between electric cooperatives, and a private channel used within a given electric cooperative. No mention of this form of operation has been found in the FCC's rules on industrial radio.

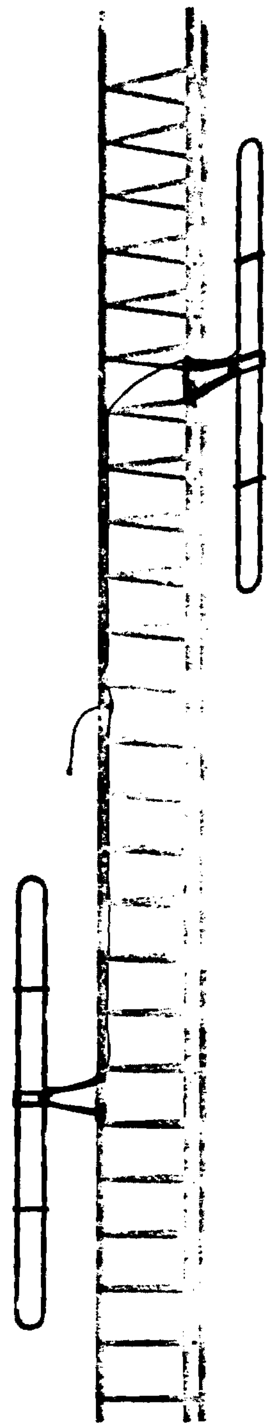
APPENDIX D

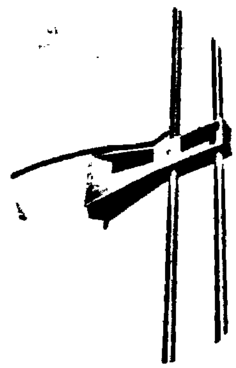
Antenna Data

Up to
12 dB GAIN

DB-212
25-54 MHz

SIDE MOUNT GAIN ANTENNA





THE DB-212 series antennas are designed to provide the optimum in gain, tower utilization, lightning protection and precipitation static reduction when mounted on the side of a tower. It *must* be mounted on and work against a metallic member parallel to and slightly longer than each folded radiator. This metallic member can be a tower leg or a pipe extending along the face of a tower or wood pole. Each antenna is cut to a specified frequency, fully assembled and factory adjusted for minimum VSWR to assure optimum performance. No further field pruning or adjustment is required.

MODELS. The antenna is available in models which include two, three, four or six half wave dipole elements. The suffix numeral following the model indicates the number of elements in the array. All DB-212 series antennas are supplied with all necessary mounting brackets and clamps as well as the required interconnecting harnesses (which terminate at the center of the array). On special order, the antenna can be supplied with longer cable harnesses and/or oversized mounting clamps for installation on larger towers (6′ face or greater).

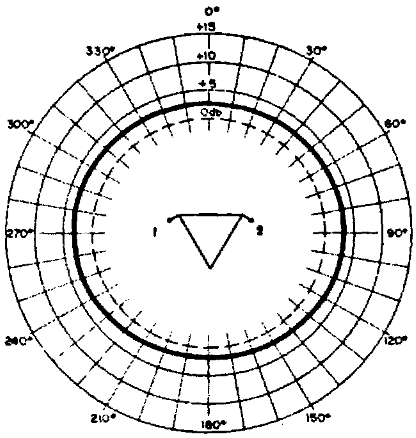
CIRCULAR PATTERN. When installed as recommended (see inside pages) on towers of normal size, these antennas can be mounted so as to provide a radiation pattern that is essentially circular. The tower size for good circularity depends somewhat on the frequency of operation, but tower sizes of 18″ to 36″ across the face are considered to be of normal size. See Figure 2 for detailed information.

OFFSET PATTERN. When all elements are mounted on one leg of a triangular or square tower (collinear mounting), the antenna will provide a broad directional pattern with maximum gain occuring in the direction the elements face. The size of the tower has very little effect on the forward gain but gain to the backside decreases as the face dimension of the tower increases. Detailed information is shown in Figure 1.

LIGHTNING AND PRECIPITATION STATIC problems are reduced with use of this side mounted antenna as compared to top mounted antennas. Additional protection from precipitation static can be achieved by ordering the antenna wrapped with electrical grade poly tape. Since it is constructed entirely of metal (except for the cable harness), with all elements operated at DC ground, the antenna is virtually immune to lightning damage.

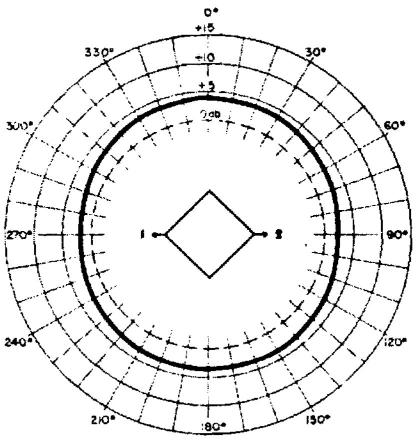
DB-212-2 (2 elements)

TRIANGULAR TOWER



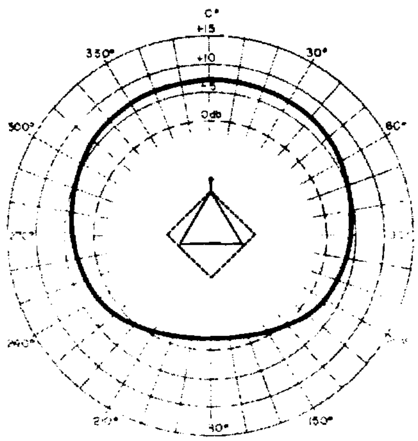
A

SQUARE TOWER



B

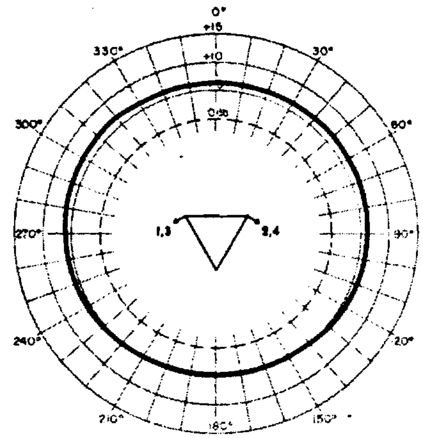
COLLINEAR MOUNTING



C

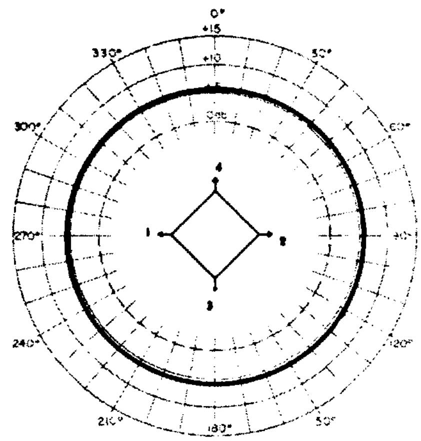
DB-212-4 (4 elements)

TRIANGULAR TOWER



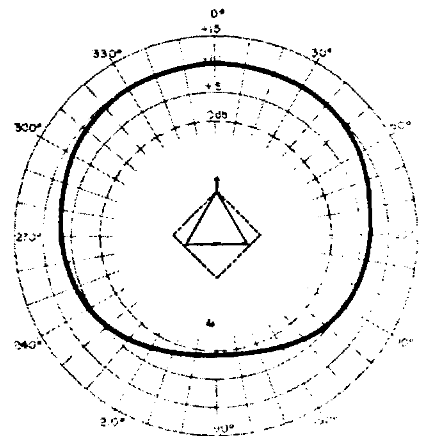
D

SQUARE TOWER



E

COLLINEAR MOUNTING



F

ıe graphs above and to the right show the radiation patterns, in dB referenced to a vertical half wave dipole, r the several models of the DB-212 series antennas when mounted on triangular and square 18-24 inch towers, measured across the face of the tower. The small numerals on these graphs indicate the placement of the ıtenna elements beginning with the number 1 element at the top of the tower.

ıe gains for the antennas mounted on larger towers are indicated in Figure 1 (offset pattern) and Figure 2 ircular pattern) on the next page.

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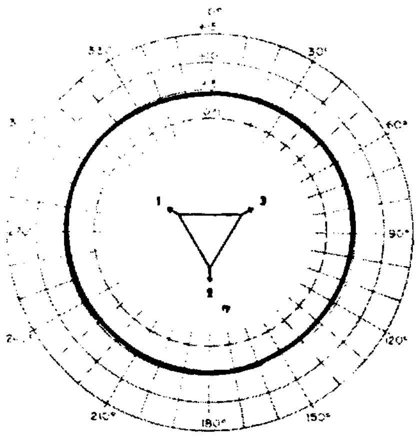
DB-212-3 (3 elements)

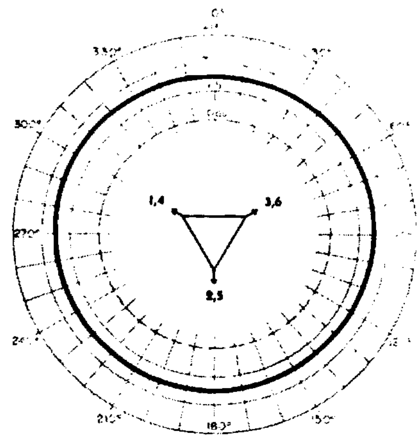
TRIANGULAR TOWER



G

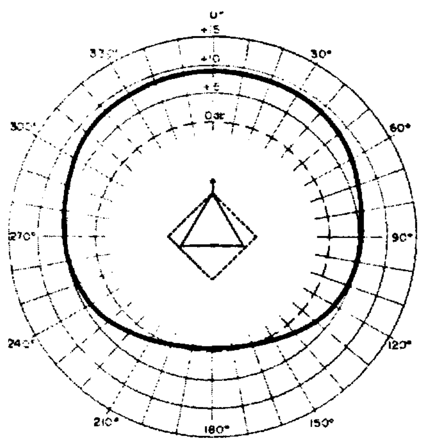
DB-212-6 (6 elements)

TRIANGULAR TOWER



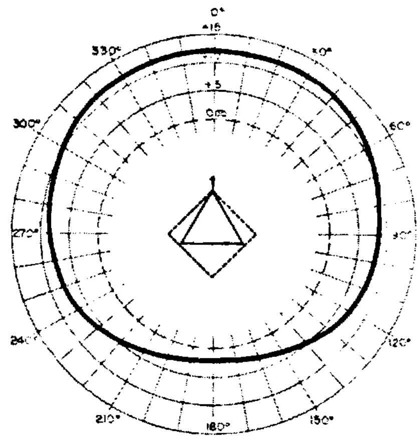
I

COLLINEAR MOUNTING



H

COLLINEAR MOUNTING



J

Figure 1

OFFSET PATTERNS ON LARGER TOWERS

The gains for the DB-212 series antennas mounted collinearly (all elements on same tower leg) will vary somewhat with the size of the tower face. The graphs above and to the left (C, F, H and J) illustrate the radiation patterns of the antennas when mounted collinearly on towers measuring 18″ to 24″ across the face. The following table shows the gains (at 40 MHz) for the various antenna models when collinearly mounted on larger towers. 0° is the direction from the center of tower through the antenna elements.

TOWER SIZE

Antenna Model	4′ FACE			6′ FACE			8′ FACE		
	0°	90/270°	180°	0°	90/270°	180°	0°	90/270°	180°
DB-212-2	7.6 dB	3.7 dB	–3.5 dB	7.3 dB	3.5 dB	–5.0 dB	7.2 dB	3.3 dB	–7.0 dB
DB-212-3	9.1 dB	5.2 dB	–2.0 dB	8.8 dB	5.0 dB	–3.5 dB	8.7 dB	4.9 dB	–5.5 dB
DB-212-4	10.6 dB	6.7 dB	–0.5 dB	10.4 dB	7.0 dB	–2.0 dB	10.3 dB	6.5 dB	–4.0 dB
DB-212-6	12.1 dB	8.2 dB	1.0 dB	11.9 dB	8.5 dB	–0.5 dB	11.8 dB	7.0 dB	–2.5 dB

Figure 2

CIRCULAR PATTERNS ON LARGER TOWERS

Maximum gain and circularity will be obtained when the DB-212 series antennas are mounted on relatively small (cross section) towers. However, larger towers can be effectively utilized if properly planned for. The table below shows the average gain to be obtained as well as the degree of circularity; i.e., the amount above or below average, when the various antennas are mounted on the legs of larger triangular towers. The tower size is measured across the face of the tower. The maximum gains will be found off the tower face, the minimum gain off of the tower leg.

TOWER SIZE:		2' FACE	4' FACE	6' FACE	8' FACE
DB-212-2	Avg. Gain	+2.8 dB	+2.0 dB	+1.6 dB	+0.7 dB
	Circularity	±0.7 dB	±1.3 dB	±2.0 dB	±3.5 dB
DB-212-3	Avg. Gain	+4.7 dB	+4.0 dB	3.0 dB	+2.2 dB
	Circularity	±0.3 dB	±0.6 dB	±1.1 dB	±2.0 dB
DB-212-4	Avg. Gain	+6.0 dB	+4.8 dB	+4.2 dB	+3.2 dB
	Circularity	±0.7 dB	±1.3 dB	±2.0 dB	±3.5 dB
DB-212-6	Avg. Gain	+7.7 dB	+6.9 dB	6.3 dB	+4.7 dB
	Circularity	±0.3 dB	±0.6 dB	±1.1 dB	±2.0 dB

Figure 3

TOWER HEIGHT LIMITATIONS — MECHANICAL DATA

The effective height of an antenna array is lowered as the length of the array is increased. For this reason there are minimum tower height limitations that should be observed when using the DB-212 series of antennas if their potential is to be realized. These minimum heights depend on the frequency of operation and the antenna model. These recommended minimums are listed in the table below along with mechanical information. The usable height of a tower is normally considered to be the height of the structure itself plus the site height above average terrain at the base of the tower.

Model	Frequency	Vertical Span on Tower (Approx.)	Maximum Exposed area	Wind Load at 100 mph	Minimum Recommended Tower Height	Net Weight	Shipping Weight
DB-212-2 . . .	30 MHz	48 ft.	3.6 sq. ft.	144 lbs.	125 ft.	32 lbs.	53 lbs.
	35 MHz	40 ft.	2.9 sq. ft.	116 lbs.	110 ft.	31 lbs.	47 lbs.
	40 MHz	40 ft.	2.4 sq. ft.	96 lbs.	100 ft.	30 lbs.	43 lbs.
	45 MHz	31 ft.	2.1 sq. ft.	84 lbs.	85 ft.	28 lbs.	39 lbs.
	50 MHz	31 ft.	1.9 sq. ft.	76 lbs.	80 ft.	27 lbs.	35 lbs.
DB-212-3 . . .	30 MHz	79 ft.	5.4 sq. ft.	216 lbs.	165 ft.	67 lbs.	98 lbs.
	35 MHz	67 ft.	4.4 sq. ft.	176 lbs.	130 ft.	65 lbs.	89 lbs.
	40 MHz	61 ft.	3.6 sq. ft.	144 lbs.	125 ft.	58 lbs.	82 lbs.
	45 MHz	51 ft.	3.2 sq. ft.	128 lbs.	110 ft.	50 lbs.	75 lbs.
	50 MHz	51 ft.	2.8 sq. ft.	112 lbs.	105 ft.	43 lbs.	70 lbs.
DB-212-4 . . .	30 MHz	110 ft.	7.2 sq. ft.	288 lbs.	320 ft.	78 lbs.	120 lbs.
	35 MHz	86 ft.	5.8 sq. ft.	232 lbs.	260 ft.	74 lbs.	106 lbs.
	40 MHz	85 ft.	4.8 sq. ft.	192 lbs.	240 ft.	70 lbs.	96 lbs.
	45 MHz	69 ft.	4.2 sq. ft.	168 lbs.	205 ft.	64 lbs.	86 lbs.
	50 MHz	69 ft.	3.8 sq. ft.	152 lbs.	190 ft.	60 lbs.	76 lbs.
DB-212-6 . . .	30 MHz	174 ft.	10.8 sq. ft.	432 lbs.	495 ft.	134 lbs.	196 lbs.
	35 MHz	134 ft.	8.7 sq. ft.	348 lbs.	400 ft.	130 lbs.	178 lbs.
	40 MHz	133 ft.	7.2 sq. ft.	288 lbs.	365 ft.	116 lbs.	164 lbs.
	45 MHz	107 ft.	6.3 sq. ft.	252 lbs.	315 ft.	100 lbs.	150 lbs.
	50 MHz	106 ft.	5.7 sq. ft.	228 lbs.	295 ft.	86 lbs.	140 lbs.

ELECTRICAL DATA

Frequency range . . . . 25-54 MHz
Bandwidth . . . . 2% of frequency
VSWR . . . . 1.5 to 1 or less
Nominal impedance . . . . 50 ohms
Gain (over half wave dipole) . . . . . . See patterns
Maximum power input . . . . 500 watts
Lightning protection . . . . Direct ground
Standard Termination: Captive Type N male attached to end of flexible lead. Other fittings are available on special order.

MECHANICAL DATA

Materials:
Radiating elements . . . 6063-T832 aluminum, ¾" dia. with ⅞" dia. socket
Mounting bracket . . . . 355 cast aluminum
Mounting straps . . . Stainless steel band clamps

Wind rating
Survival (w/o ice) . . . . 125 mph
Survival (½" radial ice) . . . . 80 mph

Mounting: Stainless steel banding straps are supplied with the antenna and fit round tower members up to 3" OD, angle members up a to 2½" on a side. Other size straps can be supplied on special order.

DECIBEL PRODUCTS, INC.
P. O. BOX 47128 • 3184 QUEBEC ST. • DALLAS, TEXAS 75247 • 214 [illegible]

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ANALYSIS AND DESIGN OF A TELECOMMUNICATIONS SYSTEM FOR VOLUNTEER ELECTRIC COOPERATIVE (INTERIM REPORT)

By

Charles S. Wilson

Prepared for

VOLUNTEER ELECTRIC COOPERATIVE
P.O. Box 277
Decatur, Tennessee 37322

Under

Project A-2463

COMMUNICATIONS SYSTEM DIVISION
ELECTRONICS TECHNOLOGY LABORATORY
Engineering Experiment Station
Georgia Institute of Technology

January 1981

FOREWORD

This study was conducted by the Engineering Experiment Station at Georgia Tech. The work was performed in the Electronics Technology Laboratory, Mr. D. W. Robertson, Director, and was conducted under the general supervision and management of Mr. R. W. Moss, Chief of the Communications System Division. Mr. C. S. Wilson was project director.

The assistance of Mr. Jerry Dover, General Manager, Volunteer Electric Cooperative is gratefully acknowledged as is the cooperation of numerous VEC employees.

1.0 Introduction

The objective of this research and study program is to provide guidance, recommendations, and design concepts to Volunteer Electric Cooperative for the purpose of meeting their present and future telecommunication needs.

The general purpose of this interim report is to (1) provide current project status, (2) indicate project direction, and (3) outline some possible solutions to Volunteer Electric Cooperative's telecommunications needs. At present, various telecommunication areas have been considered in a general overview; however, an in-depth study of these telecommunications needs has not been completed at this time; additional study and analysis are currently underway. The results of the current efforts will be to provide Volunteer Electric Cooperative with specific recommendations and design concepts.

Considering Volunteer Electric Cooperative's needs in the areas of (1) centralized dispatching, (2) land-mobile communications, (3) supervisory control, (4) data processing, and (5) load management, it is important to point out that because of the interrelation between these five areas a cohesive telecommunications system is necessary. A cohesive system is here defined as an ability for all offices, sub-offices, sub-stations, and personnel to have ready access to a centralized telecommunications system. One means by which this telecommunications system could be implemented, at least in a limited manner, would be through use of land-mobile radio and leased telephone lines. An improved alternative would be a microwave backbone throughout the entire geographical area served by Volunteer Electric Cooperative. The overall approach in this study is to consider both interim solutions to current telecommunication needs as well as long-term solutions. Of major concern is to ensure that any interim solutions which may be implemented will not cause undue complications as the long-term solutions are eventually are put into operation.

2.0 Centralized Dispatching

Within Volunteer Electric Cooperative, dispatching exists at present only on a localized basis; there is no centralized dispatching. Although localized dispatching is of value for a limited geographical region, there still exist a number of problem areas, in particular in the current difficulty of after-hours dispatching where a customer has a power outage or other difficulty which must be handled by VEC service personnel. Often, long delays occur between the time a customer attempts to report a difficulty and the time-of-arrival of service personnel; commercial answering services are used in some areas to help alleviate the problem. However, even then once a customer makes a trouble report to the answering service, considerable time may elapse before the answering service is able to locate and subsequently dispatch the VEC service personnel. Exclusive use of answering services for after-hours dispatching, as is the present case, also results in additional payroll costs to VEC since service personnel must be maintained on active standby to receive calls from the answering service.

A possible interim solution to this difficulty, would be a hybrid local/centralized dispatching configuration as illustrated in Figure 1. Such a configuration would be particularly useful for after-hours service calls. The primary basis for this centralized dispatching concept is the use of existing leased telephone lines which are currently used to interconnect computer terminals at the various sub-offices to the main computer located in the Decatur office. At present, these leased lines are utilized for computer needs during normal hours but are idle at all other times. In addition to the patch-through-to-Decatur configuration, there could also be capability for localized patching to an answering service or even directly to the serviceman's home. The selected patch configuration would depend on specific circumstances and existing needs. When the more centralized configuration was selected then a call would be placed from the customer directly to the Decatur-located dispatcher. After taking the call the dispatcher would dial up the local office (Jamestown in this illustration) and acquire access to the TELEPHONE-TO-RADIO INTERCONNECT. Once acquired, the dispatches would then establish a voice link directly to either a service vehicle, as here illustrated, or to a radio beeper as carried by the assigned service personnel.

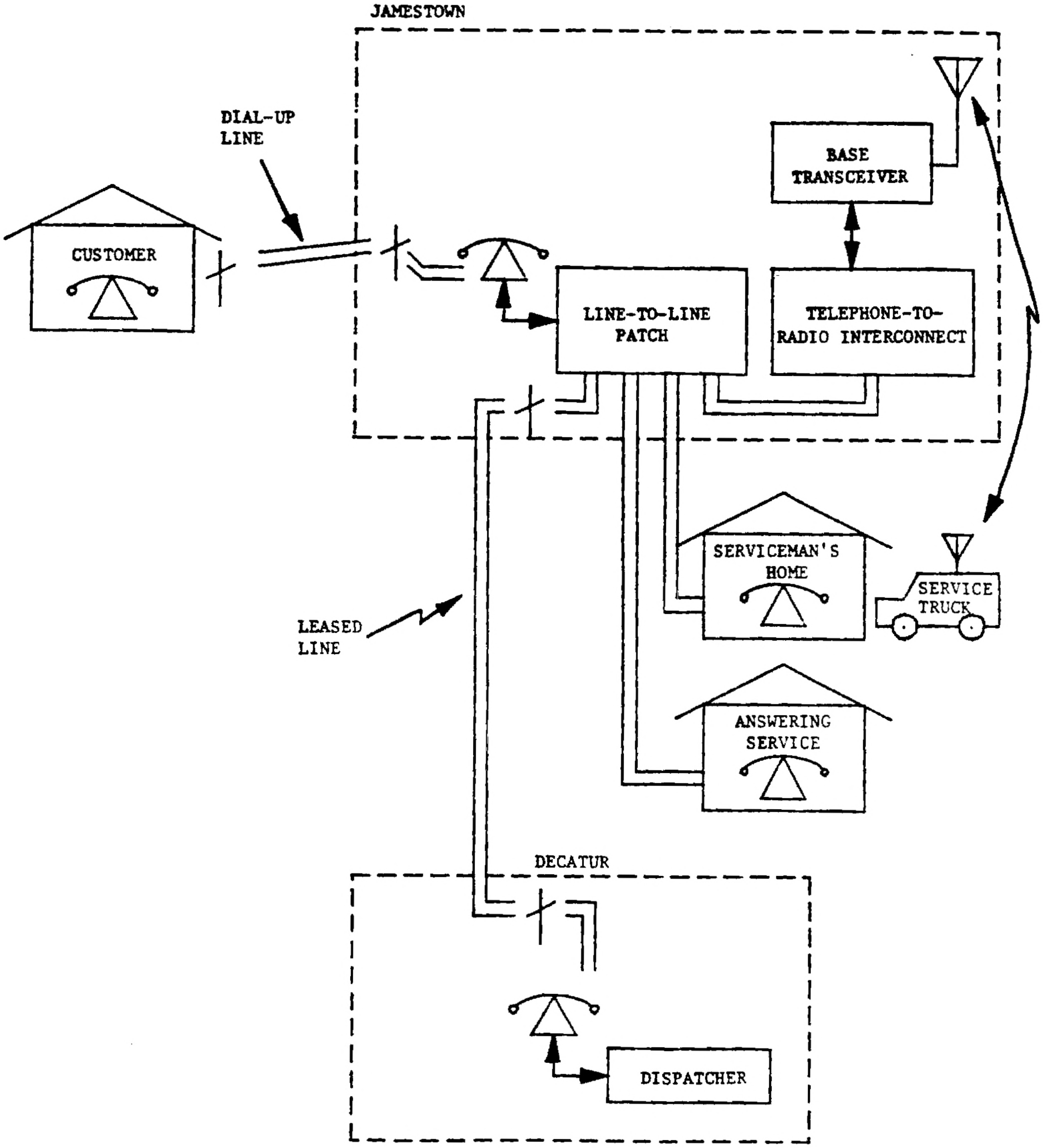


Figure 1. A possible Scenario for After-hours Dispatching.

There are several disadvantages in using the leased telephone lines for centralized dispatching, particularly as they exist within the geographical territory served by Volunteer Electric Cooperative. The first of these difficulties arises from the fact that there are three telephone systems which serve the total VEC area, the telephone systems being Twin Lakes, General Telephone, and South Central Bell. A communications link through several telephone systems can led to difficulty in identifying the source and responsibility for a problem. The approximate area served by each of the three telephone systems is shown in Figure 2. Further difficulties of leased lines are long term costs, and the inherent bandwidth limitations; this latter limitation being particularly critical for certain non-voice (e.g. data) applications. If leased lines are utilized to meet current centralized dispatching needs, they should be considered only as an interim measure until a full microwave system can be implemented.

A recent alteration in Volunteer Electric Cooperative's structure may have a limited effect on the manner in which a centralized dispatching system would be implemented. Originally, Volunteer Electric Cooperative was divided

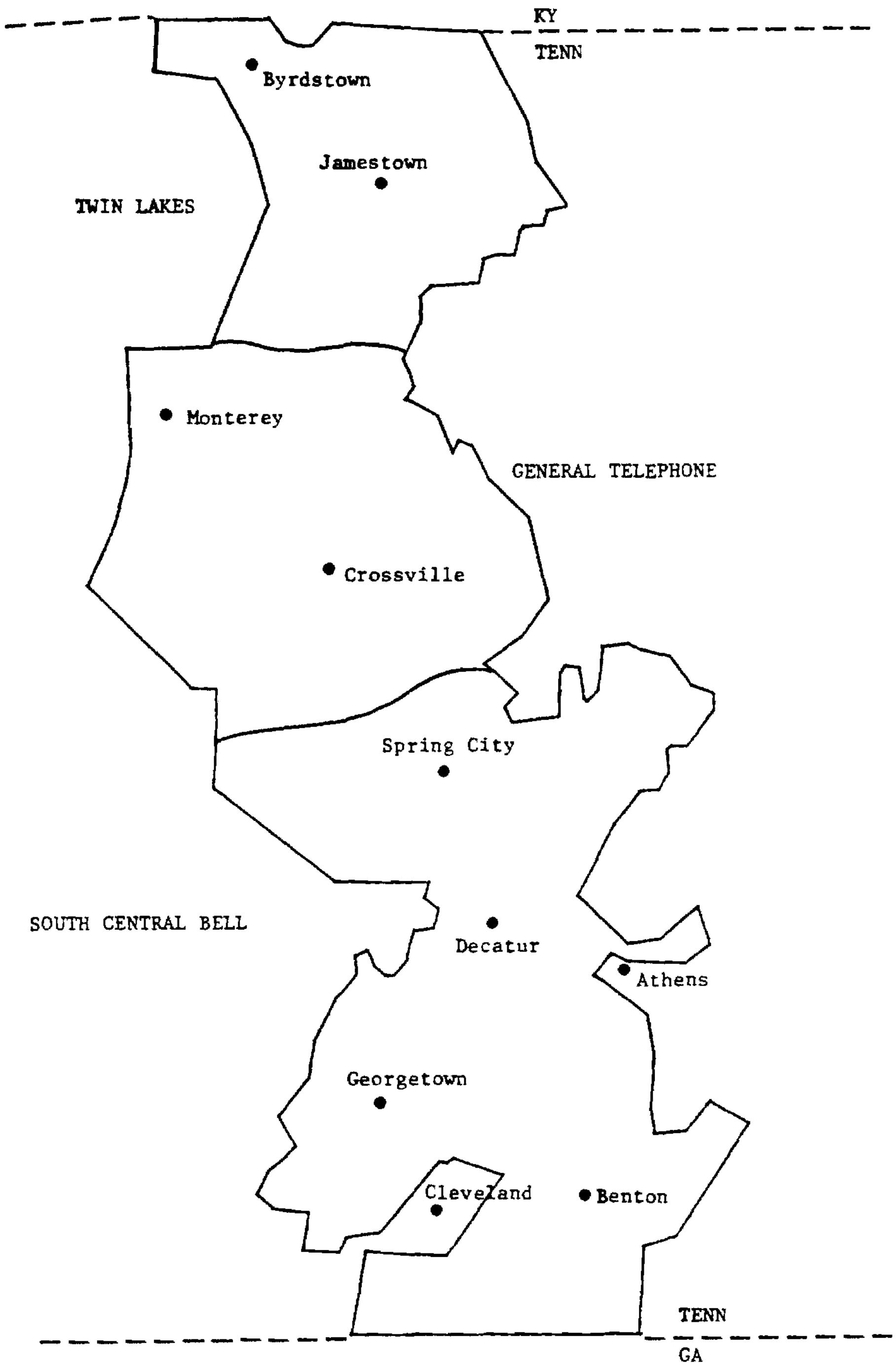


Figure 2. Telephone Systems Serving Volunteer Electric Cooperative.

into five districts with each district having a main office, and in some cases one or two sub-offices within a given district. In addition, a number of sub-stations existed with each district. This original configuration is illustrated in Table 1. During a recent reorganization, the five districts were replaced by four service areas with each of the four service areas having one main office. Then within each service area, there exists two or more sub-offices. As before, each service area contains a number of sub-stations. One original sub-station (i.e. Parksville) will be phased out as a part of the reorganization; however, two new sub-stations will be added to the Cumberland Plateau Service Area (i.e. the old Crossfield District), additions being the the Lantana sub-station in 1981, and the Tansie Sub-station in 1983. Table 2 provides a listing of the new service areas, service centers, as well as the main offices and the sub-stations. For convenience, the old district office names are also included in parentheses within this table. Figures 3 and 4 illustrate the approximate boundaries of the original districts and the new service areas respectively.

The primary task yet to be accomplished, leading to an interim

TABLE 1. ORIGINAL VOLUNTEER ELECTRIC COOPERATIVE ORGANIZATION

DISTRICT	MAIN OFFICES	SUB-OFFICES	SUB-STATIONS	
CLEVELAND	CLEVELAND	BENTON	McDONALD PARKSVILLE OCOEE BENTON	CHARLESTON HOPEWELL
DECATUR	DECATUR	SPRING CITY GEORGETOWN (HAMILTON COUNTY)	HAMILTON GEORGETOWN RICEVILLE DECATUR	ATHENS TEN-MILE SPRING CITY
CROSSVILLE	CROSSVILLE	-NONE-	CROSSVILLE CRAB ORCHARD MAYLAND	
MONTEREY	MONTEREY	-NONE-	MONTEREY RAVENSCROFT	
JAMESTOWN	JAMESTOWN	BYRDSTOWN	JAMESTOWN GRIMSLEY BYRDSTOWN	

TABLE 2. CURRENT VOLUNTEER ELECTRIC COOPERATIVE ORGANIZATION

SERVICES AREAS (DISTRICT) (1)	MAIN OFFICES	SERVICES CENTERS (SUB-OFFICES)	SUB-STATIONS	
HIAWASSEE VALLEY (CLEVELAND)	CLEVELAND	CLEVELAND BENTON	McDONALD OCOEE BENTON	CHARLESTON HOPEWELL PARKSVILLE (2)
RIVER BASIN (DECATUR)	DECATUR	DECATUR SPRING CITY GEORGETOWN	HAMILTON GEORGETOWN RICEVILLE	DECATUR ATHENS TEN-MILE SPRING CITY
CUMBERLAND PLATEAU (CROSSVILLE)	CROSSVILLE	CROSSVILLE MONTEREY (NONE) (3)	CROSSVILLE CRAB ORCHARD MAYLAND MONTEREY	RAVENSCROFT LANTANA (in '81) TANSIE (in '83)
HIGHLAND (JAMESTOWN)	JAMESTOWN	JAMESTOWN BYRDSTOWN	JAMESTOWN GRIMSLEY BYRDSTOWN	
(MONTEREY)				

NOTE: (1) THOSE NAMES IN PARENTHESES ARE THE FORMER NAMES.
(2) PARKSVILLE SUB-STATION HAS BEEN REMOVED FROM SERVICE.

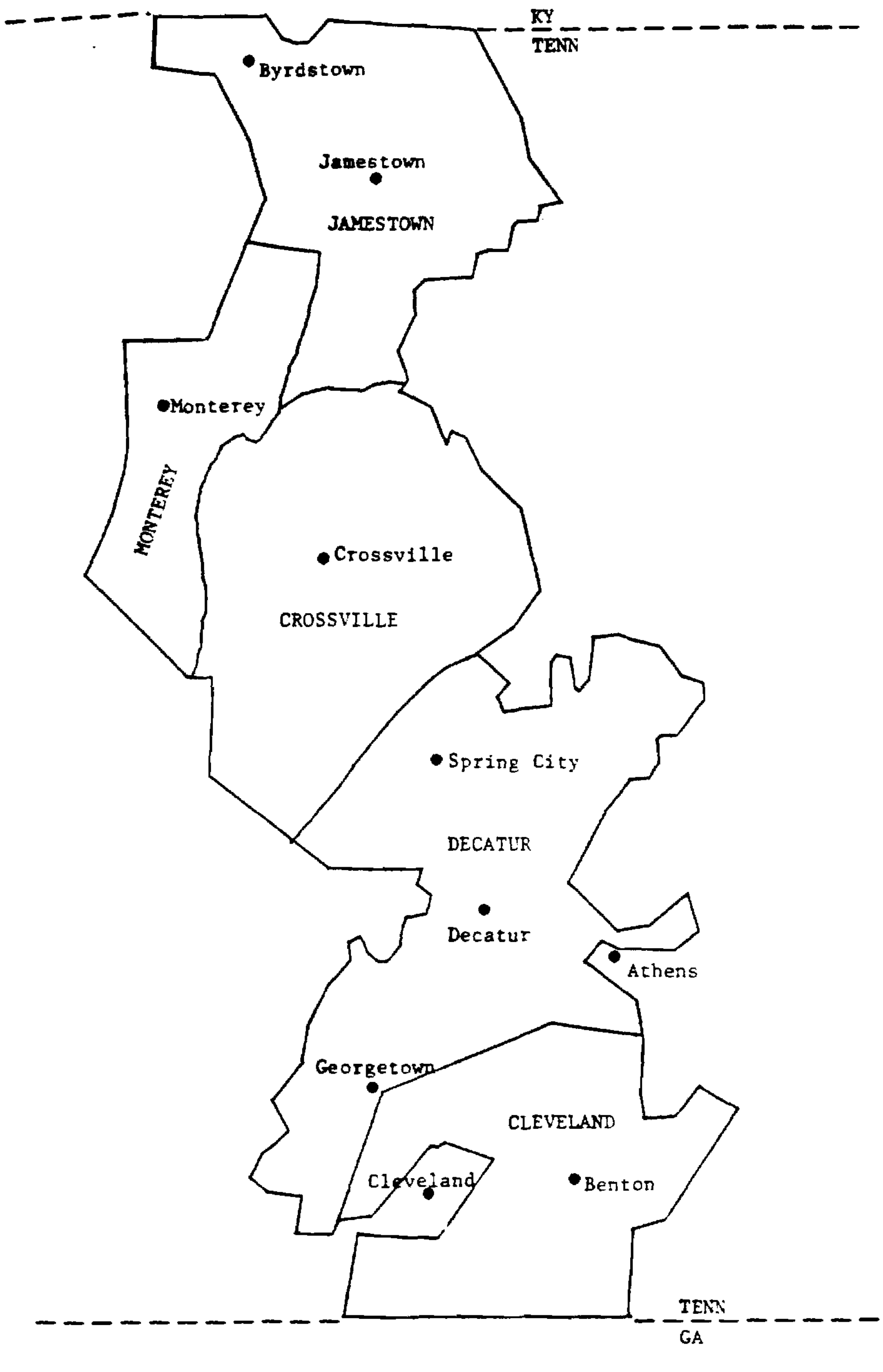


Figure 3. Original Districts Within Volunteer Electric Cooperative.

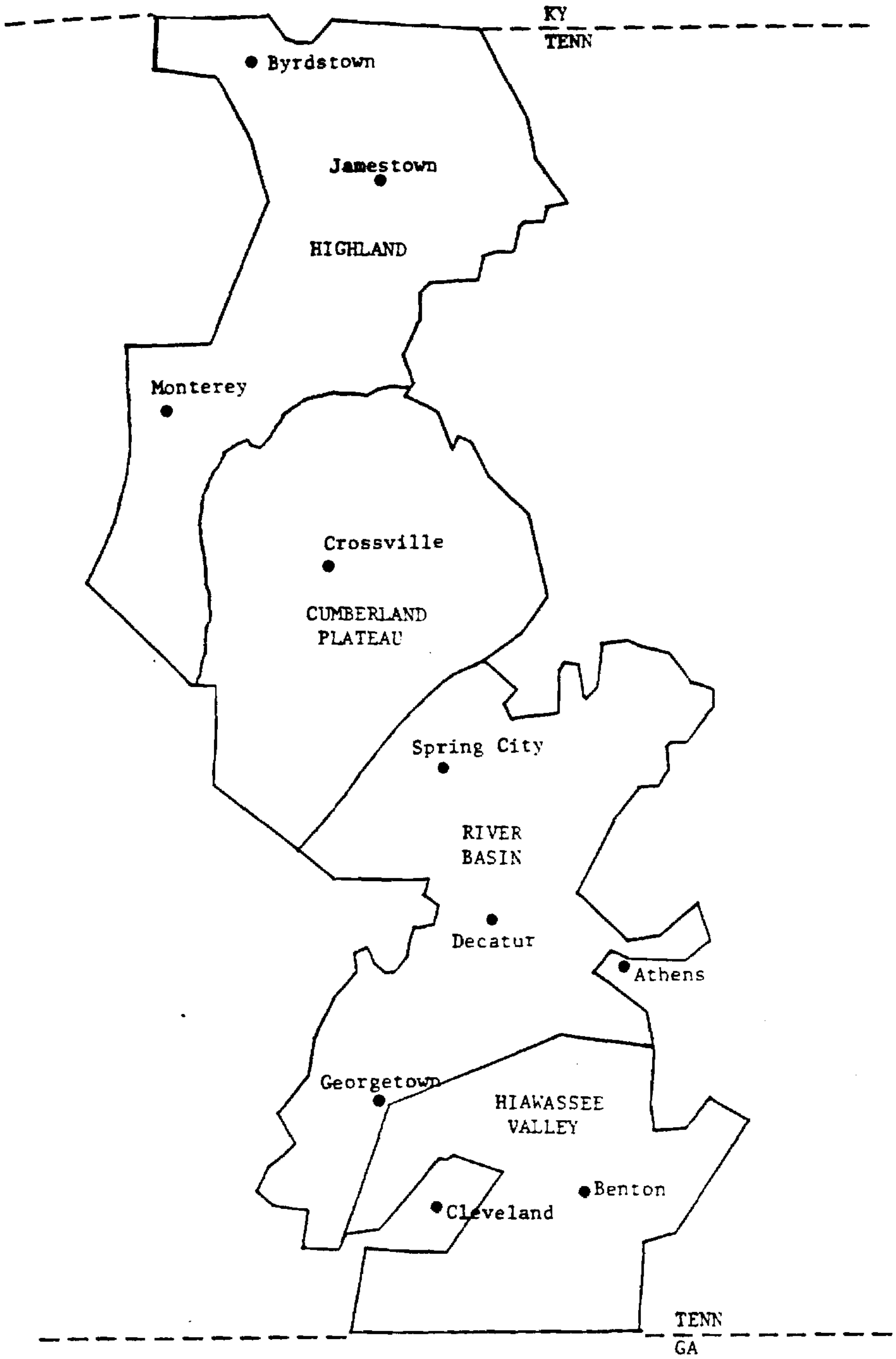


Figure 4. Service Areas Within Volunteer Electric Cooperative.

centralized dispatching concept, is a specific list of candidate configurations utilizing leased telephone lines, their respective costs, and advantages and disadvantages of each of the several concepts. Information is also being acquired on telephone-to-radio interconnect equipment. Some technical information on equipment for possible use in implementing this interim centralized disptaching system has been acquired and additional information is either soon expected or currently being pursued. It is important to realize that any centralized dispatching system utilizing leased telephone lines should be considered as only temporary at best. The long term goal should be implementation of a full microwave system.

3.0 Land-Mobile Communications

The present Volunteer Electric Cooperative land-mobile radio system operates at low-band VHF, specifically two channels at frequencies of approximately 37 MHz. In addition to the land-mobile frequencies, there is one repeater, located on Cottonport Ridge, which can be accessed from the Decatur, Georgetown, and Cleveland offices. The office-to-repeater link is at a frequency of 72.9 MHz. The repeater-to-mobile frequency is again approximately 39 MHz. Even through use of this repeater, however, only moderate radio coverage can be achieved throughout most of the southern portion of Volunteer Electric Cooperative, a major factor being interference as a result of the extreme congestion within the lower VHF portion of the spectrum; adverse terrain parameters also influence the radio coverage characteristics. In the northern portions of VEC (i.e. the Cumberland Plateau and Highland Service Areas) radio coverage is reported as being somewhat better than in the south even though a repeater capability does not here exist. This somewhat better coverage appears to be the result of more satisfactory terrain characteristics; again, however, interference remains a major problem.

Figure 5 illustrates the present radio configuration by showing the operating frequencies at the various locations and the tower heights associated with each of the base radio stations; tower heights are indicated by the numbers in parenthesis. A comprehensive analysis of the existing land-mobile radio system was included in the earlier report entitled "Study and Evaluation of the Volunteer Electric Cooperative Communication System," dated March 1980.

The fundamental difficulties which are associated with the present land-mobile configuration must be resolved if improved radio communications are to be realized. Basically, the difficulties center around (1) the present operating frequencies, (2) an insufficient repeater system and (3) absence of a communications backbone or interconnect system (i.e. a microwave network).

Because of the spectrum congestion and other problems associated with the low-band VHF portion of the radio spectrum, a need exists to move either to high-band VHF or to the UHF portion of the spectrum. High-band VHF would be

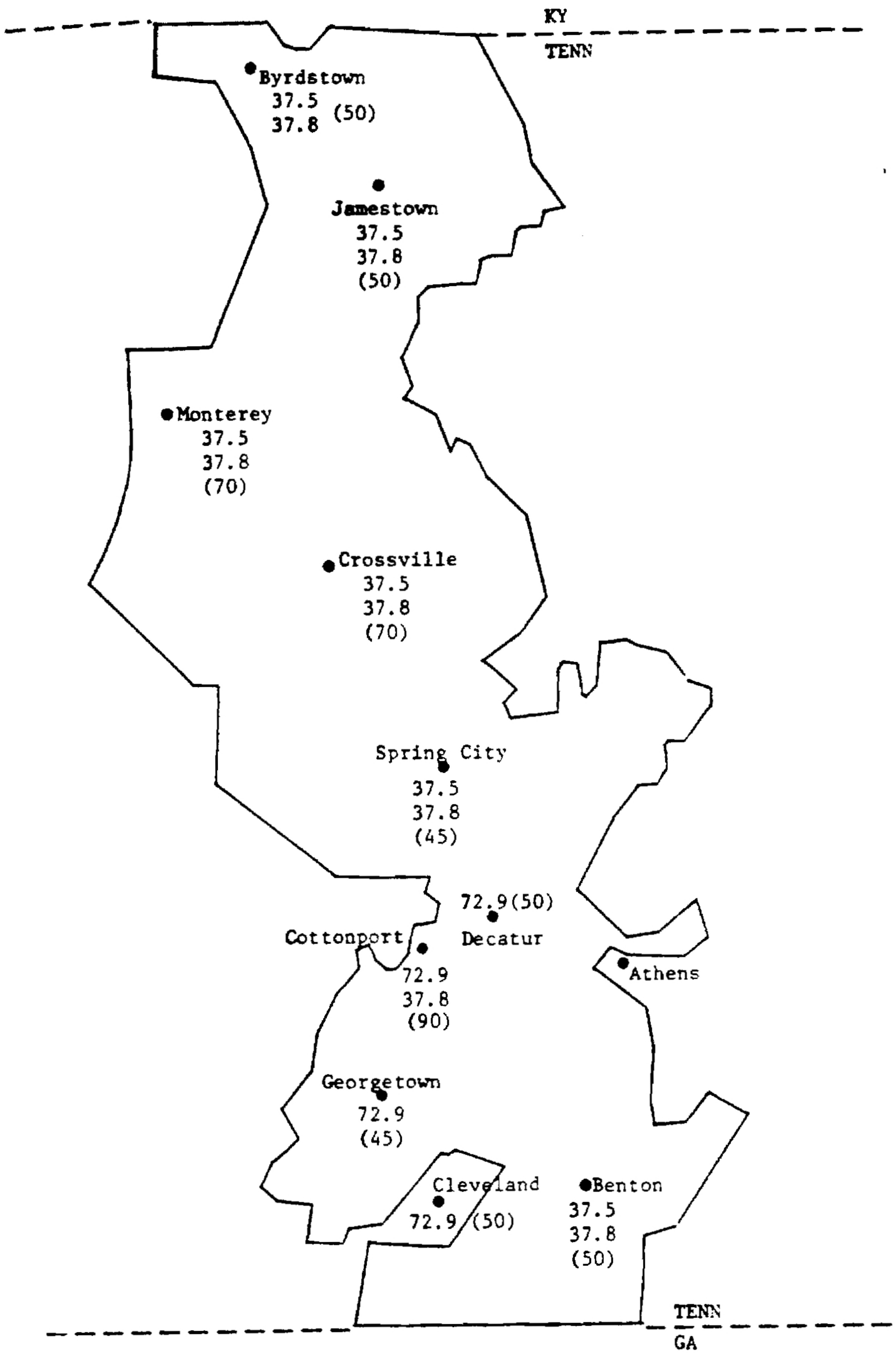


Figure 5. Existing Radio Frequencies and Tower Heights.

in the frequency range of approximately 170 MHz, whereas UHF operation would occur at approximately 450 MHz. High-band VHF, i.e. 170 MHz, is attractive from the standpoint that propagation characteristics under terrain conditions similar to that of Volunteer Electric Cooperative are reasonably good; whereas use of the 450 MHz band would be less suitable for the terrain conditions which exist within VEC; factors other than terrain must, however, be considered. The difficulty with the 170 MHz band is the large population of current users that already exists within that portion of the spectrum. This is particularly true since Volunteer Electric Cooperative is reasonably close to both Chattanooga and Knoxville where 170 MHz channels are already in extensive use; there simply may not be any suitable 170 MHz channels available. If true then the 450 MHz portion of the spectrum is a logical alternative. It is interesting to note that 450 MHz is currently being used for land-mobile operations even within difficult terrain areas. As an example, the Kentucky state police now have a statewide land-mobile radio system operating in the 450 MHz portion of the spectrum and are reporting very satisfactory communication system performance. The initial portion of this system was installed at Pikesville, Kentucky which is very mountainous and near the Virginia and West Virginia border. The state of Kentucky's concept was that if it would work in that portion of the state, they could then be assured that it would work anywhere else in the state.

Two other examples of 450 MHz being used for land-mobile communications in rural areas are: Gibson County Electric Membership Cooperative in west Tennessee, and one district within Georgia Power Company. In this latter case, Georgia Power is operating a 450 MHz land-mobile communications system out of Summerville, Georgia which is in the northwest corner of the state.

The terrain conditions for the Gibson County EMC is quite different from Volunteer Electric Cooperative since Gibson County is in the western part of Tennesse near the Mississippi River. However, the UHF system operated by Georgia Power in northwest Georgia is under similar terrain conditions as that which exists for Volunteer Electric. One major difference, however, between the area served by Georgia Power Company (within this specific district) is that the land area in that district is considerably less than the total land area of VEC. For both Gibson County EMC as well as Georgia Power, the entire telecommunication system is supported by a microwave network.

Within Gibson County EMC, only one land-mobile repeater is required, that repeater being at Troy, Tennessee. In addition, there are three satellite receivers which are located at Alamo, Trenton, and Tiptonville. These satellite receivers are then interconnected with the primary land-mobile repeater over the microwave network. Gibson County EMC is able to operate with a single land-mobile repeater primarily because of two factors: 1) a total geographical region which is considerably less than Volunteer Electric, and 2) the fact that the terrain is relative flat in that portion of the state. In contrast, the system operated by Georgia Power Company requires four transmitters (or repeaters) to cover their entire geographical area even though the land area is actually less than the area covered by Gibson County EMC. The major difference between the two systems is, of course, the more mountainous terrains within Georgia Power Company's district. The UHF system operated by Georgia Power Company is a "Simulcast" configuration with equipment being supplied by Motorola. Simulcast is advantageous from the standpoint that a network of satellite receivers, and an associated interconnect, back to the land-mobile repeater is not required. In a Simulcast configuration, all transmitters operate concurrently and with the transmitters interconnected by the microwave network. An additional advantage of Simulcast is the fact that all transmitters operate on the same frequency, whereas for the multiplicity of radio repeaters, each repeater must be assigned an individual channel in order to not interfere with other repeaters within the system. A major disadvantage of the Simulcast system is that for the system to operate satisfactorily, the operating frequency of the several transmistters must be very accurately matched with increased maintenance time required to ensure continued satisfactory operation.

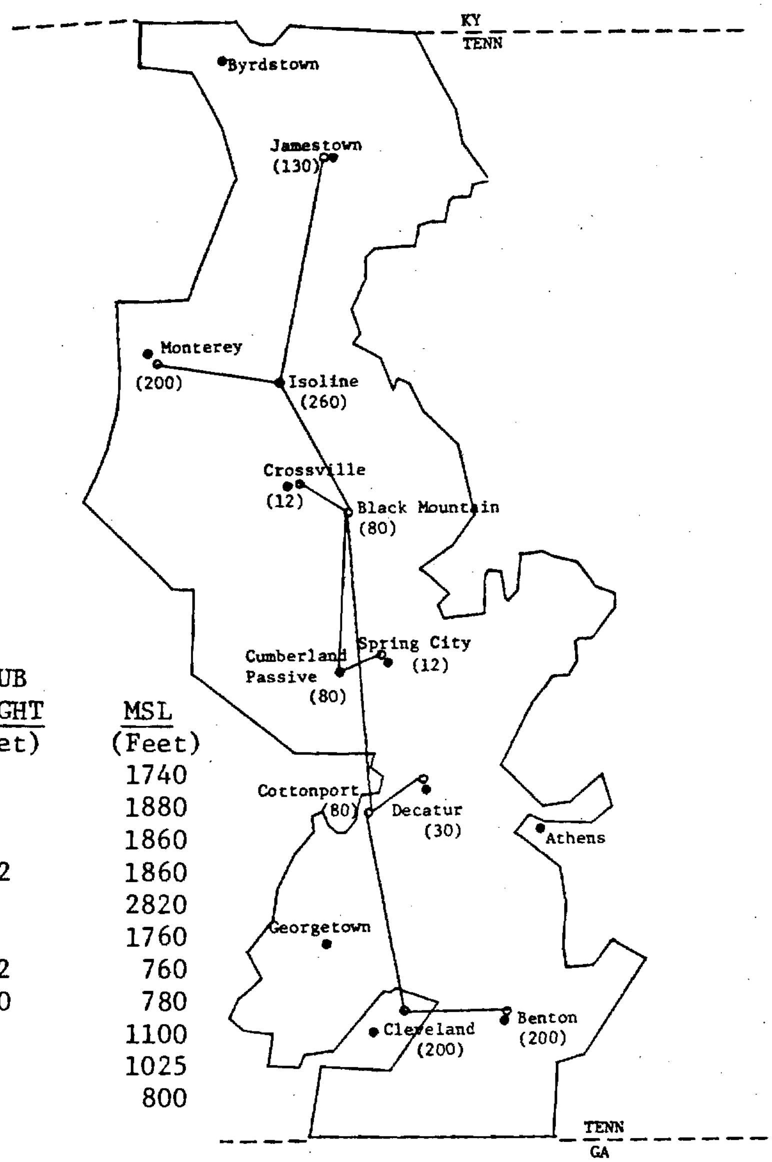
For Volunteer Electric Cooperative the use of a single radio repeater, as is done at Gibson County EMC, would not be possible because of both the terrain and the large land area covered by VEC. The Simulcast configuration is a possible alternative for VEC; however, the attendant problems must be considered and tradeoffs with the more conventional network of repeaters must be analyzed.

Further study and analysis for existing 450 MHz systems, such as the two described above, is underway. The purpose of this study and analysis is to identify advantages and disadvantages of such systems and to define a specific configuration which will meet the needs of VEC's land-mobile communications system requirements.

4.0 Microwave System

As has been stressed in earlier sections of this report, a microwave network must be considered as an important element of any full-scale telecommunications system for Volunteer Electric Cooperative. This fact has has been realized earlier by VEC personnel in that Motorola performed a microwave survey for VEC in 1974. As a result of this survey, it was specifically recommended that a total of eight towers and three stubs be installed within VEC to provide a full capability microwave network. The location of these several towers and stubs, their respective heights, and the base elevations is provided in Figure 6. One location listed in the figure, specifically Black Mountain, is no longer available since that location is now occupied by a tower installed by the FAA. However, other sites within the area, specifically Brady Mountain, are still viable locations. It should be noted that, as shown in Figure 6, a tower is not indicated for Byrdstown. It is likely that a tower was included in the original Motorola study but was not a part of the information provided by VEC to Georgia Tech.

Since tower costs are a major item in any microwave system, every effort



LOCATION	TOWER HEIGHT (Feet)	STUB HEIGHT (Feet)	MSL (Feet)
Jamestown	130		1740
Monterey	200		1880
Isoline	260		1860
Crossville		12	1860
Black Mountain	80		2820
Cumberland Passive	80		1760
Spring City		12	760
Decatur		30	780
Cottonport	80		1100
Cleveland	200		1025
Benton	200		800

Figure 6. Proposed Motorola Microwave Network Configuration.

will be made to minimize both the total number of towers and the tower heights. One possible configuration for achieving this goal is illustrated in Figure 7. In this case, towers are still required at Georgetown, Monterey, and Isoline as well as Black Mountain, or an equivalent location such as Brady Mountain. However, the 200 foot towers at Cleveland and Benton, as illustrated in Figure 6, are now replaced with stubs; in addition the "Cumberland Passive" and Cottonport towers would no longer be required. Stubs may be possible at Cleveland and Benton by placing a large tower, perhaps 200 feet, on Chilhowee Mountain. Such a configuration could allow a straight-line shot from Chilhowee Mountain to Black Mountain. From Chilhowee Mountain then, microwave links may then be established directly to Benton, Cleveland, Decatur, Spring City, through use of stubs at these locations. Possible heights of these stubs may be on the order of 30 feet, thus significantly reducing costs when compared with 200 foot towers. A detailed terrain profile will be performed to determine if this Black Mountain to Chilhowee Mountain link is feasible. Additional terrain analysis will likewise be performed to ensure that a satisfactory link can be established between Chilhowee Mountain and the four other locations, in particular the link between Chilhowee

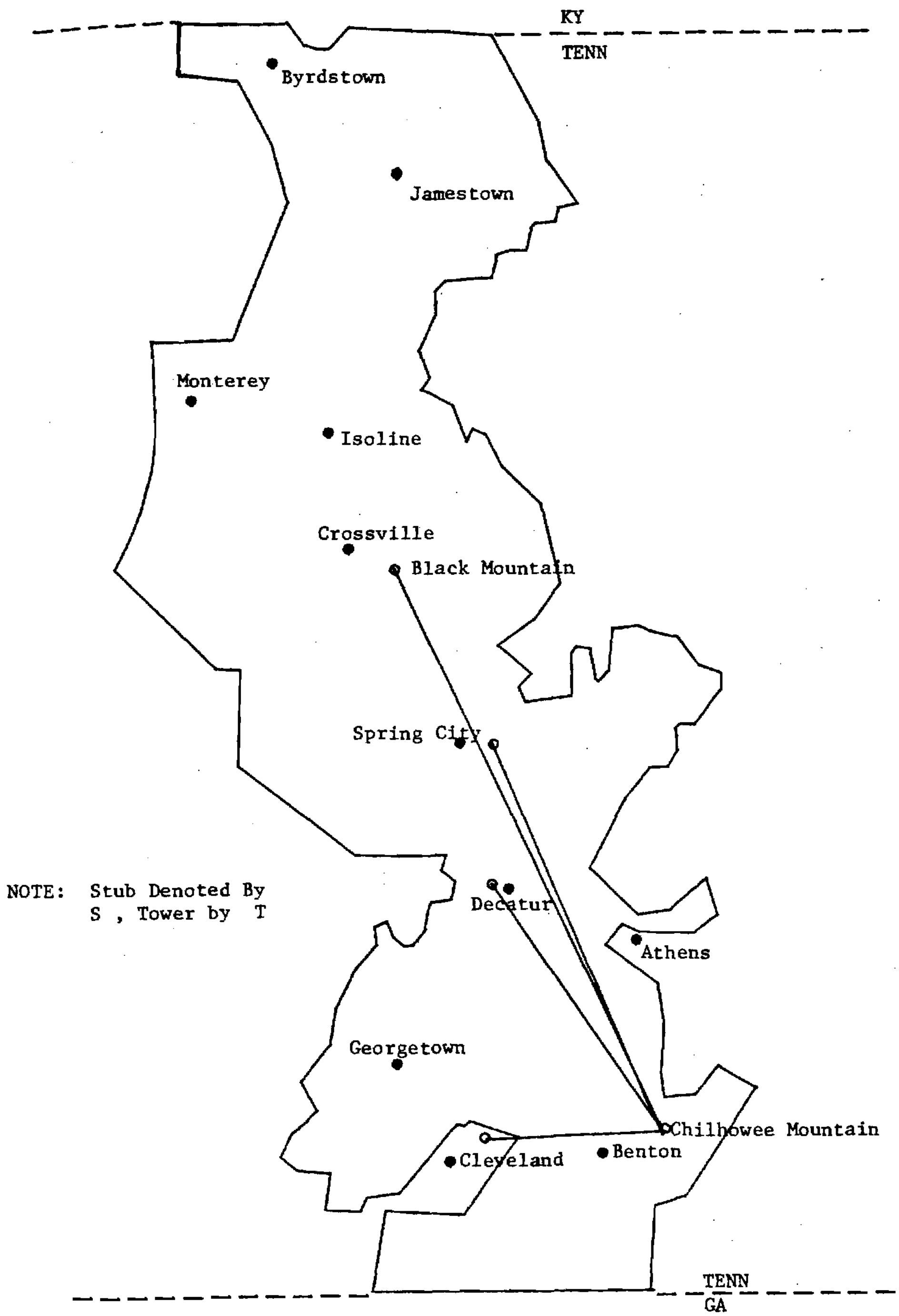


Figure 7. Alternative Microwave Network Configuration.

Mountain and Spring City.

As a part of the overall microwave network study and analysis for VEC, a copy of the Motorola proposal to Gibson County EMC has been obtained for study and review. It is expected that the information provided in this proposal will be of additional benefit in the analysis of microwave requirements for Volunteer Electric Cooperative.

5.0 Summary

Current efforts in this analysis and design of a telecommunications system for Volunteer Electric Cooperative are being directed to long-term as well as short-term solutions. A difficulty, though not insurmountable, with any short-term solution is to ensure that a large dollar investment will not be made in a system which will not be eventually compatible with long-term needs.

The on-going efforts to analyze existing 450 MHz land-mobile communications systems, particularly those such as being operated by Georgia

Power Commpany and the Kentucky State Police, are providing valuable information as to the advantages as well as areas of concern or caution in such an approach. Information acquired to date indicates that the cost for a full-scale telecommunication system for Volunteer Electric Cooperative (including a microwave network) will be on the order of $750,000.

As a further part of the current efforts, Georgia Tech is continuing to pursue various system approaches which includes several possible communication configurations as well as specific equipment required to implement these configurations. The microwave system analysis is also an important part of this analysis.

DESIGN OF AN INTERIM APPROACH TO CENTRALIZED DISPATCHING FOR VOLUNTEER ELECTRIC COOPERATIVE

By

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Under

Project A-2463

COMMUNICATIONS SYSTEMS DIVISION
ELECTRONICS AND COMPUTER SCIENCE LABORATORY
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1. INTRODUCTION

1.1 Objective

This report addresses the problem of establishing an interim centralized dispatching service for the Volunteer Electric Cooperative's (VEC) service area. The recommended configuration presented is to be an intermediate measure to the implementation of a complete, multi-function communications network.

1.2 Scope

This report provides VEC with a recommended configuration for such an interim service and includes a budgetary estimate and an itemized equipment list.

The design utilizes VEC's present radio network employed in its land-mobile operation and provides a means to more effectively dispatch service personnel to problem sites throughout the local service areas.

Essentially, the configuration makes use of already existing leased lines between the central office in Decatur and local offices. The configuration also employs statewide WATS lines already in service and the Cottonport repeater. The dispatching function will be distributed among the local offices, the central office in Decatur, and one answering service.

In all cases, it is assumed that the system implemented is temporary and will be replaced when a permanent, integrated communications network is implemented.

2. OPERATING REQUIREMENTS

2.1 Present Operation

At present, VEC provides service to 14 counties in Tennessee. However, as discussed in the interim report submitted by EES/CSD in January, 1981, no centralized dispatching currently exists. VEC does enlist two answering services and one telephone company for limited dispatching in a few areas. Table 2-1 summarizes their services. At present, it is not unusual for there to be a long delay between the time a customer requests service and the time when the requested service is provided. Much of this delay is attributed to the current, non-centralized dispatching arrangement. Also, the present dispatching scheme has significant disadvantages for both the utility and the service personnel. In particular, the movement of on-duty service personnel is restricted since they are required to be immediately accessible by telephone. This inconvenience imposed upon service personnel is the basis for the disadvantage to the utility. The union representing the service personnel dictates a premium wage for this service, even though no actual service work may be performed during a given operator's on-call period.

Each service center presently dispatches service personnel during business hours. In the three cases described in Table 2-1, answering or paging services provide after-hours and, in some cases, 24-hour dispatching service. At present, although two inbound WATS lines do provide statewide customer access to the Decatur facility, these lines are only used to provide inbound access for the Decatur service area. The central office does not dispatch any personnel via radio transmitter to locations outside the service area of the central site except in the case of the Cottonport repeater.

In areas where no answering service is employed, customers are provided with a list of home telephone numbers of service personnel. They are then instructed to call through the list until they reach someone who can respond to their need.

TABLE 2-1

PRESENT DISPATCHING AND ANSWERING SERVICES
EMPLOYED BY VEC

COMPANY	SERVICE AREA	SHIFT	LEVEL OF SERVICE	COST
Cherokee Answering Service	Polk, McMinn Meigs, Bradley Counties	5 p.m.-8 a.m. (M-F) 24 hrs. Wknds/Hols.	Answering service; one-way paging	$225 per mo.(1)
General Telephone Company	40 mi. radius in Putman Cty., incl. Monterey	24 hrs. continuously	One-way paging only	$26 per mo. plus charges for LD call
Sonitrol of Cumberland Tri-County	Cumberland County	24 hrs. continuously	Answering serivce; one-way paging	$100 per mo.(2)

(1) Cherokee will upgrade present service to include two-way paging with answering services within its present service area for about $250 per month total for a 12 a.m.-8 a.m. shift.

(2) Sonitrol will upgrade present service to include two-way paging with answering services within its present service area for about $135-$140 per month total.

2.2 Projected Interim Operation

In an effort to expedite improvement in dispatching services, VEC has expressed the desire to implement an interim solution. As was outlined in the GIT/EES Interim Report, one approach would be to utilize the present land-mobile radio network. As was discussed, this option is the most cost effective and convenient approach as an interim solution.

Use of the present land-mobile network would provide dispatching services to those areas where radio transmitters presently exist (see Figure 2-1). Coverage reliability per district was investigated and described in detail in the "Study and Evaluation of the Volunteer Electric Cooperative Communications System," March 1980. Table 2 of that report is included in this report as Table 2-2 for the convenience of the reader. Coverage for the existing network is highly variable, ranging from "poor" to "excellent." Ordinarily, such coverage would be considered unacceptable; however, an objective of the present design task is to define an approach which can be implemented promptly, at the least cost, and with coverage consistent with that of the mobile radio network. Therefore, given this objective and the short-term estimated life of the solution (1 to 2 years), it is assumed that utilization of the land-mobile network with no modifications is acceptable.

The proposed configuration would provide centralized dispatching services throughout most of the service areas, 24 hours a day, seven days per week. After business hours, one answering service would be employed, via an "off premise extension," to answer and dispatch calls to 22 service personnel on duty throughout the service area. Additionally, either the area manager, area engineer, or operations supervisior assigned to the four service areas will be provided with necessary devices to access transmitters in order to speak directly with their field personnel. Hand-held and mobile units would be signaled and, depending on the level of service selected, two-way communication would be available. If the two-way mode is preferred, VEC may further elect to purchase the necessary equipment to enable personnel in the field to

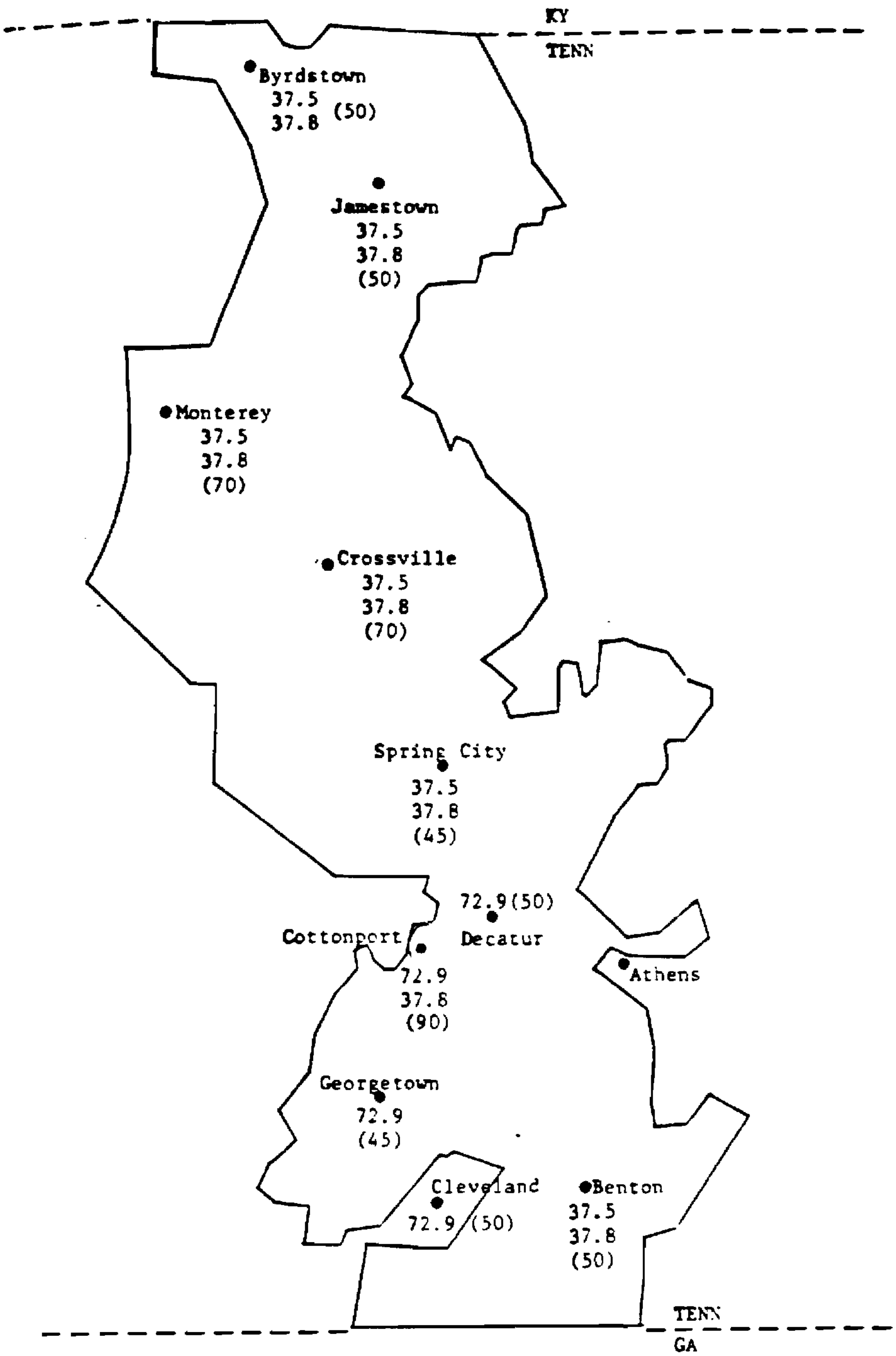

Figure 2.1 Existing Radio Frequencies and Tower Heights.

TABLE 2-2

VEC RADIO SYSTEM PERFORMANCE

Approximate District Coverage		Radio Communication Quality			
Location	Percent Coverage	Excellent	Good	Fair	Poor
Decatur	85			X	
Georgetown	75			X	
Cleveland	75			X	
Benton	60				X
Spring City	90		X		
Crossville	95	X			
Monterey	80			X	
Jamestown	90		X		
Byrdstown	90		X		

initiate a call into the dispatcher. Such a capability is particularly critical in emergency conditions and incoming signals from the field can be given priority at the transmitter over those from the dispatcher.

Inbound communications from the local offices to the dispatchers in Decatur or the answering service would be established using the leased lines which will support voice traffic as well as data. Incoming calls from customers would be patched from the Direct Distance Dial (DDD) lines to the leased lines through Bell-provided switching. The calls would be answered in turn by a dispatcher at the Decatur office or answering service.

Local dispatchers would contact service personnel in most instances via the local radio, as is the case presently in the land-mobile operation. Decatur and answering service dispatchers would activate local transmitters via the outbound WATS lines of the Decatur office. In the case of the Decatur, Georgetown, and Cleveland service areas, the Cottonport repeater would be employed, as is presently the case in land-mobile operation.

Each local office would provide answering and dispatching services from 8:00 a.m. to 5:00 p.m., the facility in Decatur would assume those functions from 5:00 p.m. to 11:00 p.m., and an answering service would provide those services from 11:00 p.m. to 8:00 a.m. Figure 2-2 presents a block diagram of projected network.

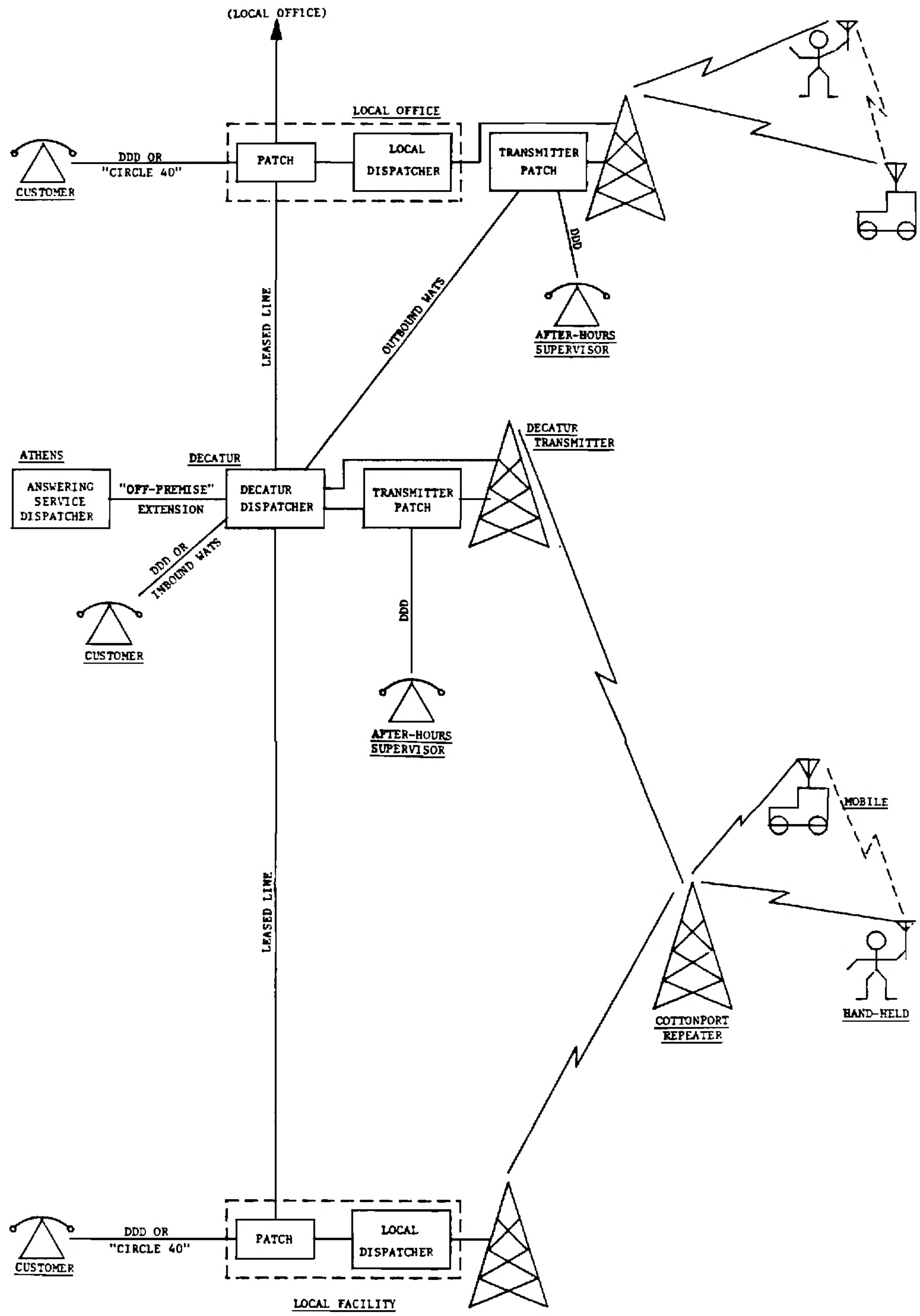

Figure 2-2. Interim Centralized Dispatching and Answering Service Configuration for Overall System.

3. PROPOSED INTERIM COMMUNICATIONS NETWORK

3.1 Customer - Dispatcher Access

It is the desire of VEC that customers throughout the VEC service area have toll-free access to a dispatcher 24 hours a day, seven days a week. To effect this objective and provide the easiest procedure to the customer, it is recommended that the number of the local office in each service area be provided to all customers and clearly identified as the point-of-contact for service requests.

In a local office during the business day from 8 a.m. to 5 p.m., a customer may call the local office and talk to the dispatcher on duty at that facility. In some cases, the service area of the local office extends beyond the local calling region for that service office. Where this is true, customers must incur the expense of a long-distance call to contact the VEC office. One means of eliminating such customer expenses in the Decatur area is to provide customers with the inbound WATS numbers. In those other service areas where a toll call is required to reach the utility office, there are no inbound WATS services. One means of providing customers with toll-free access into those offices is the "Circle Calling 40" service. The "Circle 40" service will provide 2-way telephone service for customers within a 40 mile radius of the local office. It is our present understanding that there are at most three local service areas which may require such a solution. In service areas where all calls are local, a direct dial link would be retained. Rates for "Circle 40" services are presently $12.20 for the first hour and $0.195 for each additional minute. There is a one-time service order charge of $16.00. The service charge is not sensitive to the time of day. Costs to implement a complete inbound WATS service are listed in Table 5-1 and run over $1,000 per month. The decision as to which option to elect should be made based on an analysis of load of incoming calls from the outlying areas in question. It is our understanding that South Central Bell is presently investigating that load for VEC and will report its findings in the near future.

After 5 p.m., the customer would still call the local dispatcher using the inbound WATS, "Circle 40" or DDD number published in the local directory. However, the "Circle 40" or DDD call would be switched to the Decatur office or the answering service. Switching to effect the patch between incoming DDD calls and the leased line is already in place in most cases. South Central Bell is presently working on switches in the system where they are not yet in place and is modifying the leased lines to accommodate voice wherever needed. According to Bell, VEC may expect to have a voice-grade leased line network with DDD-leased line switching available in the near future. Also, according to Bell, patching an incoming call from the "Circle-40" service to the leased line would incur no extra charge.

After 11 p.m., incoming calls from a customer would be answered by a dispatcher at the answering service via an "off premise extension." The transfer of the call from the Decatur dispatcher to the dispatcher at the answering service would be transparent to the customer.

In the configuration described above, the customer at no time speaks directly with the service personnel in the field. Customers would typically hear either a busy signal or continued ringing if the dispatcher at the Decatur office or the answering service were engaged in communications with another incoming caller or in dispatching service personnel. For those customers who would hear a continued ringing, an automatic answering set is available from South Central Bell which informs an incoming caller that all lines are busy and that calls are being taken in turn. A separate unit would need to be installed per line. Rates are $27.00 per month per unit plus a one-time installation charge of $45.00. The same unit can be used for the incoming WATS, leased, and DDD lines. As offices in Byrdstown and Jamestown are linked on a common leased line, as are the Benton and Cleveland offices, customers calling in would hear busy signals when any of the dispatchers were engaged in another call from one of the line-sharing offices. That is, if a dispatcher were speaking with a customer from Benton, the customer in Cleveland would hear a busy signal. Figure 3-1 summarizes the overall configuration.

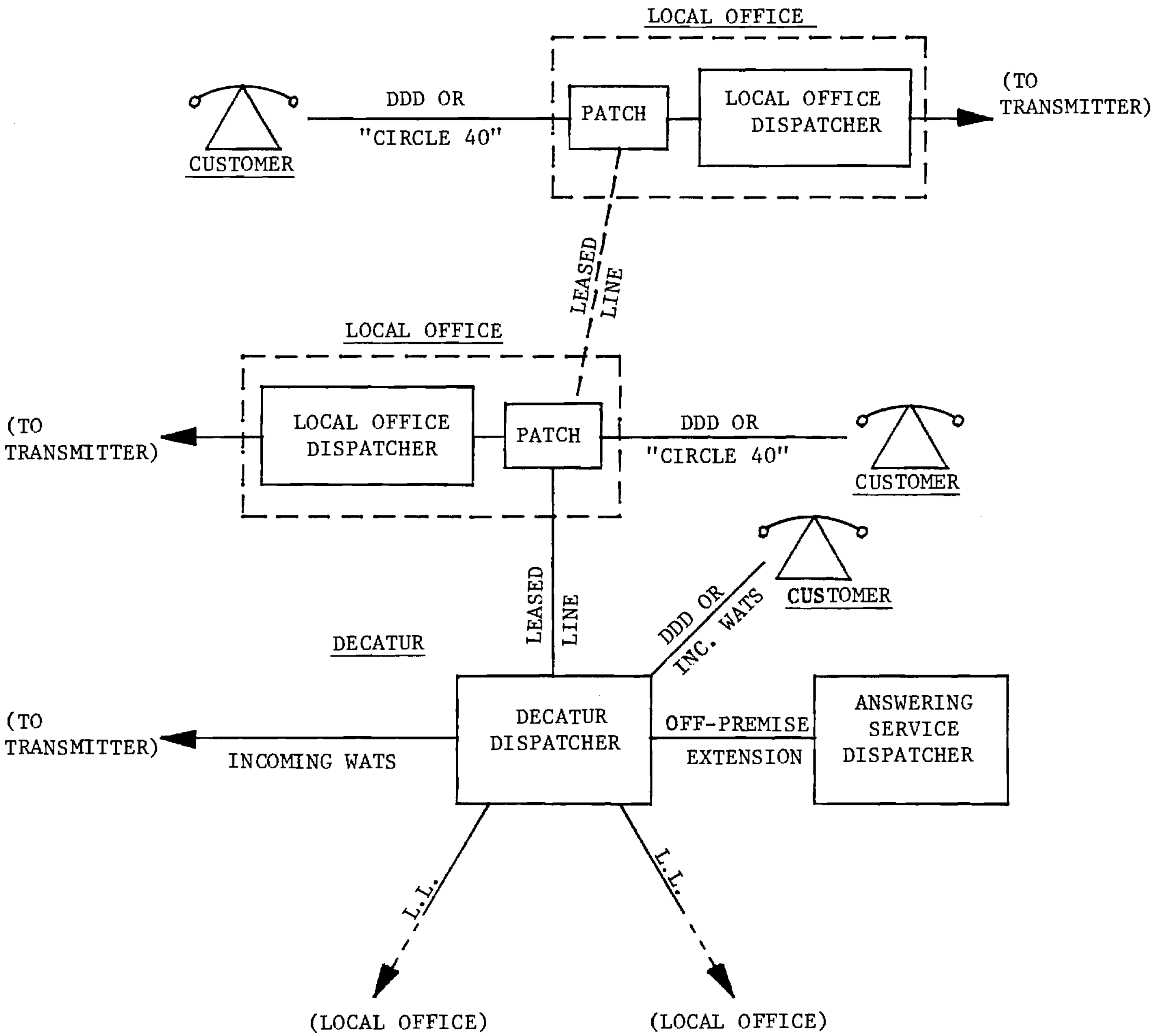

Figure 3-1. Customer-Dispatcher Access in System.

It should be pointed out that another configuration is possible. Simultaneous inbound and outbound access to and from the central dispatcher is possible without a DDD-leased line patch. Two numbers could be provided to customers in each service area - one for calls made during business hours, the other for calls made after 5 p.m. and on weekends and holidays. The latter number would be one of the statewide inbound WATS line already in service. The WATS line would give each customer direct access to the central office in Decatur or to the answering service.

3.2 Central Office Network Access

The central office in Decatur will need access to the local transmitters in order to dispatch service personnel between the hours of 5 p.m. and 11 p.m. This can be accomplished two ways, depending on the region involved.

To access the radio towers in Jamestown, Crossville, Monterey, Spring City, Byrdstown and Benton, the dispatcher at Decatur can use one of the outbound statewide WATS lines. If these lines are used, then an incoming call via the leased line will not be preempted by the dispatching function. Figure 3-2 illustrates this configuration.

To reach service personnel in the areas surrounding Decatur, Georgetown, and Cleveland, it would not be necessary to access the local transmitters. Instead, the Decatur dispatcher could use the Cottonport repeater to communicate with service personnel anywhere within those service areas directly. Access to the service areas via the Cottonport repeater is illustrated in Figure 3-3.

3.3 Answering Service Network Access

Between 11 p.m. and 8 p.m., VEC would like a single answering service, preferably one near Decatur, to provide dispatching and answering services. To effect this capability, it will be necessary to install at least one, preferably two, "off-premise exchange" extensions

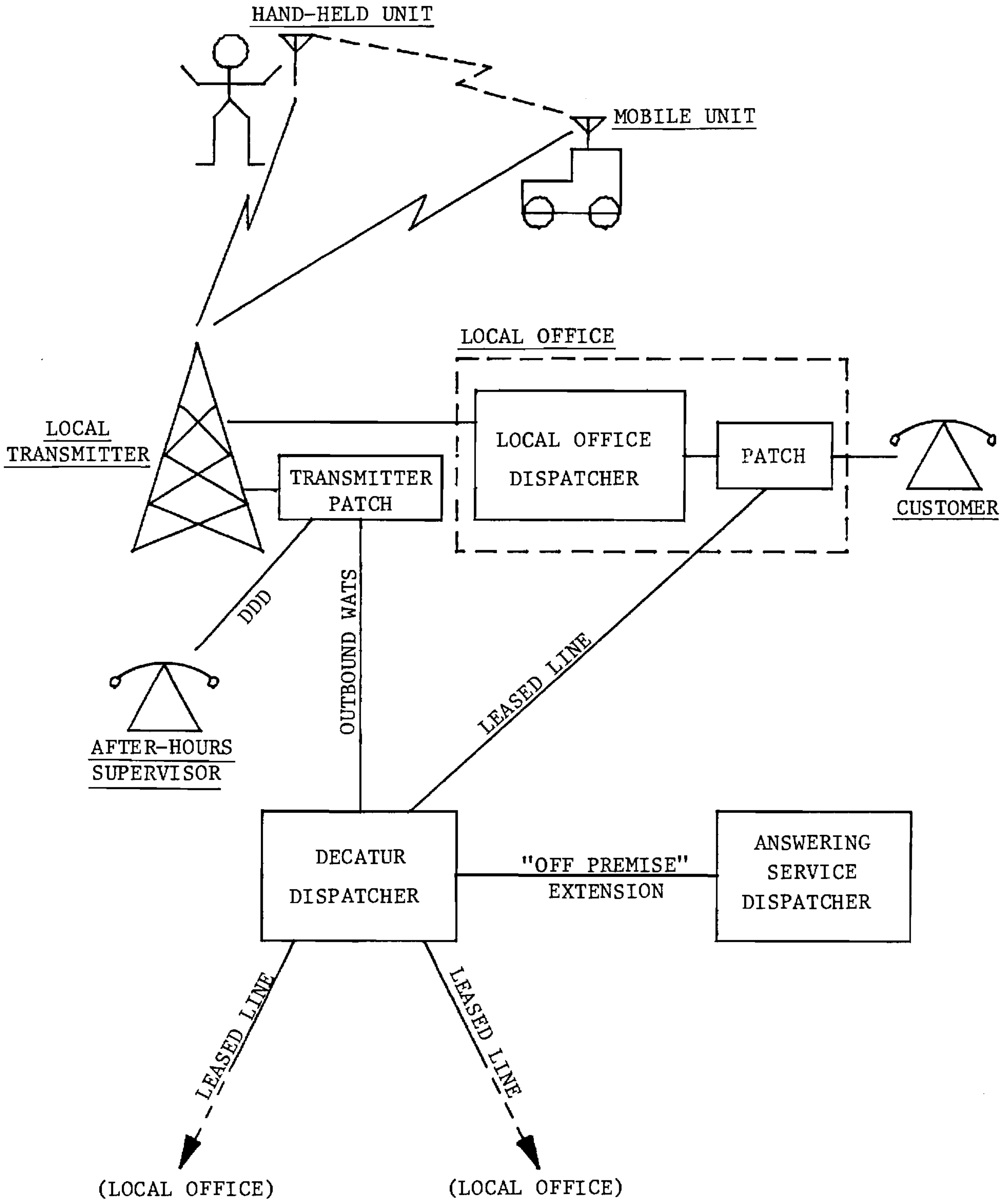

Figure 3-2. Service Personnel Access for All but Decatur, Georgetown and Cleveland Service Areas.

at the answering service. One extension will provide the answering service with access to all incoming calls into the Decatur office without any switching function. These would include all leased, DDD, and WATS lines. The answering service then would be able to answer all incoming calls one at a time. As discussed in Section 3.1, customers unable to speak immediately with the dispatcher would hear either a busy signal, continued ringing, or get a recording informing them that their call would be taken in turn.

The second extension would be used to access local transmitters. The answering service would communicate through the Decatur office. Using an outbound WATS line, to which the answering service has direct access, transmitters and service units can then be activated. To dispatch personnel in those areas accessed by the Cottonport repeater, the dispatcher at the answering service would dial up the Decatur transmiter. Once activated, this radio would access the Cottonport repeater and permit the dispatcher tone-coded access to the service personnel. Figures 3-2 and 3-3 illustrate this access. Two extensions between Decatur and the answering service then would provide more customer access to a dispatcher after 11 p.m. since there would be essentially separate incoming and outgoing lines. If there were just one line, there would be no customer access to the dispatcher while the dispatcher communicates with service personnel. It should be pointed out that technically, the extensions provide inbound or outbound access. A dispatcher could receive calls and dispatch out on either extension installed.

There was a question concerning the use of "call forwarding" as a means to provide the answering service with access to the incoming calls after 11 p.m. According to the telephone company, this method applies only to calls made through the direct dial service. Essentially, after a specified hour, the computers at Bell would simply re-route the DDD call to the answering service rather than to the Decatur office. However, service to provide "call forwarding" for inbound calls from leased lines or WATS service is not available at this time. Although technically

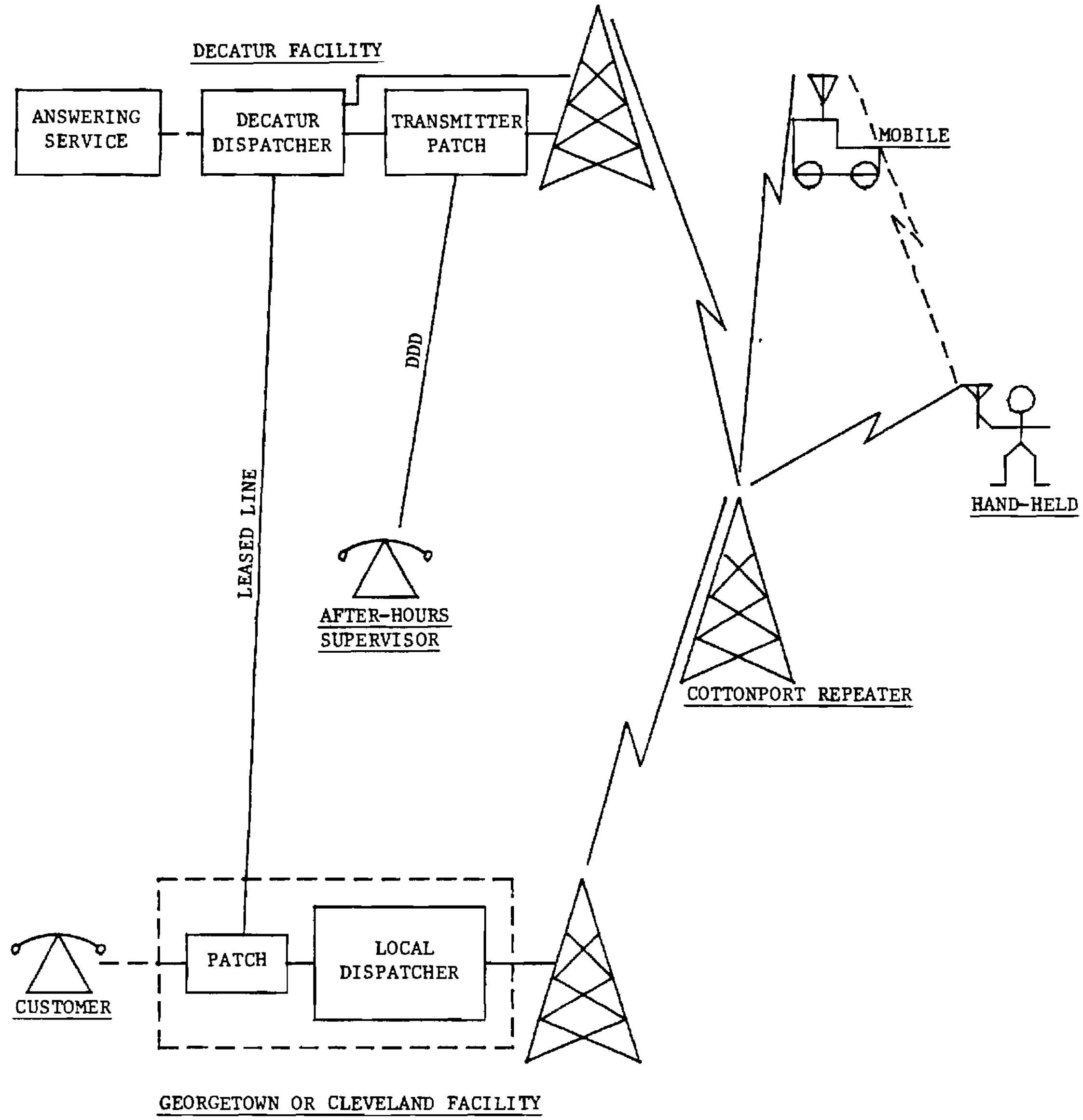

Figure 3-3. Service Personnel Access Via the Cottonport Repeater for Decatur, Georgetown, and Cleveland Service Areas.

feasible, such a service would be far less cost effective to implement than the extension service, especially given the interim nature of the solution.

Another method of linking the answering service with the Decatur office is to make use of a radio link. This method would entail procuring the necessary license from the FCC. Since VEC is anxious to implement the interim system as soon as possible, and since the lifetime of the interim system has been estimated to be between 12 and 24 months, this method is not recommended.

The discussion thus far has treated the use of VEC's radio equipment by an answering service as a simple matter. From a technical viewpoint, this is appropriate, but certain regulatory issues should be pointed out.

According to the Federal Communications Commission, as long as an answering service is under contract as an employee of the utility and the utility owns all of the radio equipment utilized by the answering service, the service becomes the employee and agent of the utility and can use the frequency for which the utility is licensed to dispatch the utility's service personnel. The contract between the answering service and the utility should include a statement to the effect that the answering service will, in fact, operate as an agent of VEC and will abide by all applicable FCC rules and regulations. This means, essentially, that the answering service must not use the licensee's equipment for any business other than that of the licensee.

VEC anticipates that the load experienced by the answering service will be small, due to the late hour shift. However, in cases of major failures, the local office manager will be contacted immediately. While the manager is in transit to the local office, the answering service may expect very heavy incoming traffic for 20 to 30 minutes. When the site manager reaches the local office, he will assume the dispatching duties, and the load at the answering service is anticipated to subside.

McMann Answering Service in Athens, Tennessee, has been contacted as a potential contractor for the answering service. The answering service is located about 15 miles from the Decatur office. McMann can provide answering services and one-way dispatching for up to 4 pairs of lines, Monday through Friday, from 11 p.m. to 8 a.m. and 24 hours per day on weekends and national holidays for $842 per month. The service can provide all of the above with two-way paging for $1,084 per month. These estimates are based on a one-year contract, to be renegotiated each contract year.

South Central Bell estimates that costs to provide an "off-premise extension" between Decatur and the McMann Service would be $105.10 per month plus $905.85 installation per extension. Each extension will provide the answering service with one pair of lines.

3.4 Service Personnel Access

3.4.1 Dispatcher-to-Personnel

To access service personnel in Georgetown, Cleveland, and Decatur, the Cottonport repeater would be used in the same way that it is currently being utilized in the land-mobile operation. A dispatcher at one of the offices accesses the Cottonport repeater and talks directly to service personnel in the field. After 5 p.m., the dispatcher in Decatur would do the same to talk to any of the personnel on duty. After 11 p.m., the answering service would dial up the Decatur radio, which would access the Cottonport repeater.

It should be pointed out that Cottonport is potentially a radio traffic bottleneck. For example, if a dispatcher in Georgetown wishes to dispatch someone in that service area and a dispatcher in Cleveland wants to dispatch personnel in the Cleveland service area, one dispatcher must wait his or her turn until the first is finished. VEC has expressed a willingness to endure this problem during the interim period.

To access service personnel at all other service areas, the dispatcher would tone-activate the target transmitter and tone-select the specific unit desired as discussed in Section 4.

3.4.2 Service Personnel-to-Dispatcher

The communications between the dispatcher and the service personnel can be either one-way or two-way. In the one-way case, the dispatcher would use the tone encoded squelch (Channel Guard) to discretely access the receive-only radio carried by a specific serviceperson. The dispatcher would follow tone-activation of the serviceperson's radio with either a verbal description of the task to be performed or a request to contact the dispatcher for additional instruction who may, in fact, be contacted via a two-way unit in a service truck. The latter approach has the advantage of providing prompt indication that service personnel have been reached and are in the process of responding.

In the two-way case, the serviceperson is provided with a two-way radio. Initial contact with the individual is accomplished as described above for the one-way case. Once the serviceperson has been alerted, he or she and the dispatcher may immediately discuss the task to be performed. This approach has the potential advantage of providing immediate indication that the individual has been reached and is responding. The disadvantage of this approach is related to the extremely rough terrain in VEC's service area. Typically, the hand-held radios use low power (1 to 5 watts) transmitters which would have a very limited range in rough terrain. Thus, a serviceperson may be able to hear the dispatcher's inquiry at many locations where the response cannot be heard by the dispatcher. This could nullify most of the benefits associated with a two-way system.

VEC does have the option of purchasing the necessary equipment to enable the personnel in the field to initiate a call into the dispatcher. Additional equipment would include a DTMF encoder for each hand-held and mobile field unit and an automatic answering unit with the necessary options at each transmitter. This equipment is further discussed in

Section 4 and listed in Table 5-2. The units identified automatically give priority to incoming signals from the field over those from the dispatcher. Additionally, the units can be provided the capability to interrupt communications between the dispatcher and another serviceperson for no additional unit cost. Such a capability is particularly important under emergency conditions.

3.4.3 After-Hours Supervisor-to-Personnel

In order for the after-hours supervisor to directly contact the service personnel in his district via his home phone, he would have to call the local transmitter on a DDD line. That call would then be connected to the radio transmitter through use of the automatic answering device discussed in Section 4 which would activate the transmitter. The supervisor would be provided with a tone encoder to address units in the field. By keying in the correct code, he would then be able to establish direct communications with service personnel using either the mobile or handheld units. This link is developed further in Section 4. At no time would a customer's access to a dispatcher be preempted by the supervisor's attempt to reach his service personnel.

For Georgetown or Cleveland, after-hours supervisors would place long distance DDD calls to the automatic answering unit at the Decatur radio. They then would be patched through to the Cottonport repeater and then to their personnel.

Another option is to equip the transmitters at Georgetown and Cleveland with the necessary equipment to effect a DDD-to-radio patch as with the other transmitters. It costs roughly $1,500 per transmitter to add this equipment, and VEC should decide whether, as an interim solution, it is willing to spend $3,000 to provide the two radios with that capability, or whether for 12 to possibly 24 months, it would be less costly to pay the long distance charges from supervisors in those two areas. As it is very likely that the supervisors would be calling after business hours when the rates are lower, it is anticipated that the charges incurred would not be that high. However, if the transmitter were so equipped, it would certainly alleviate the problem of the local dispatchers having to wait their turn to get access to the Cottonport repeater.

It is anticipated that VEC would need to purchase three encoders per maintenance area, or one for each of the three after-hours superisors per area.

3.4.4 Service Personnel-to-Service Personnel

If the decision is made to provide service personnel with two-way radios, then it will be possible for service personnel to have the so-called talk-around capability; i.e., the portable units can talk to each other directly without involving the base station or a repeater. This is particularly an advantage when several service personnel are dispatched to work on a common problem such as a downed line.

The preferred means of implementing the talk-around capability is to use two different radio frequencies. One frequency is used for communications between the base station and mobile or hand-held units. The other frequency is used for communications among mobile and hand-held units in close proximity to one another. VEC is currently licensed to use two separate frequencies, and the units recommended are two channel units as are the mobile radios. However, there is a real problem with using one of the frequencies. It has proven to be nearly useless due to very bad interference which occurs 80% of the time. This second frequency, 37.8 MHz, is used at present, but sometimes is effective only within a one mile radius, depending on the weather and sunspot activity. In order to minimize crowding the primary channel, it is advised that inter-unit communication be kept to a minimum if possible.

4. OPERATIONAL TECHNIQUES AND HARDWARE

The techniques pertaining to system control and operation and the hardware necessary to support these techniques will be discussed below. Only the dispatchers and after-hours supervisor-to-service personnel communication is considered, since South Central Bell is responsible for hardware in the customer-to-dispatcher communication link. The discussion will be divided into two areas: base station access, and selective calling.

4.1 Base Station Access

The particular technique chosen for base station access was selected for its relative ease of implementation, which is consistent with VEC's desire for rapid development of an interim centralized dispatching system.

All base stations in the system will be accessed remotely except the Georgetown and Cleveland stations, as their service areas can be covered by the Decatur station via the Cottonport repeater.

Each base station is accessed by dialing the telephone number of a particular station over one of the DDD or outbound WATS lines. If VEC selects only the telephone-to-radio patch, a typical automatic answering unit establishes an automatic patch after 8 rings. If VEC decides to provide field personnel with call-initiation capability, one such unit which incorporates both patches, establishes the patch and gives the dispatcher a tone cue and up to 4 seconds to send over more tones. Once the patch is established, the appropriate control tones are sent (generated by a remote control console) to bring "up" the transmitter. Audio signals are then generated by the tone encoder to access specific hand-held or mobile units.

4.1.1 Implementation

The base station will be controlled both locally and remotely by tones. Those base stations presently equipped with direct current (D.C.) control (excluding the Georgetown and Cleveland stations) will have to be modified for tone control. Tone control is necessary as a result of the Bell System's decision not to support continuous metallic connections in the future.

The Decatur office, the answering service, and the after-hours supervisors' homes will be equipped with a remote control console that generates the necessary base station control tones. Each local office, excluding Georgetown and Cleveland, that presently uses a direct current (D.C.) controller will be retrofitted with a tone controller to maintain system compatibility.

The communication network for the system will be standard Bell dial-up service with an automatic answering interface at the base station.

Once the voice channel (via the telephone lines) is established to the base station, and the base station is activated, communication can take place to field personnel. If the base station is within range of the field personnel's transmitters, a two-way communication link can be established.

In order to provide service personnel capability to initiate a call into the dispatcher, the transmitter must be equipped with a separate unit which will establish a radio-to-telephone patch. Such a unit, as well as, the one to provide the telephone-to-radio patch, is available from Data Signal, Inc. (DSI). DSI can incorporate all necessary units into one box for simplified installation. For no additional charge, coding can be modified to provide service personnel with the capability of disconnecting other communications on a particular transmitter in cases of emergencies. This unit also gives automatic priority to calls from the field should calls be made into a specific transmitter from a dispatcher and a serviceperson simultaneously.

4.1.2 Control Point Hardware

Hardware at the control points (Decatur office, answering service and after-hours supervisors' homes) will consist of a telephone and a remote tone control console with microphone.

The telephone will have standard pushbutton switches for switching between the dial phone and the remote console leads. This enables the user to dial the base station with the telephone and, upon connection via the automatic answering unit (discussed in the next section), to switch operation to the remote control unit.

The remote control console generates the control tones necessary to activate the accessed base station and provides a means of voice communication via the microphone associated with the control console.

Control point hardware is listed in Table 5-2 and illustrated in Figure 4-1.

4.1.3 Local Office Hardware

The hardware located at the local office includes a remote tone control console, an interconnect package, a manual switch, and a hybrid junction as listed in Table 5-2 and illustrated in Figure 4-2.

The remote tone controller initiates the base station control tones at the local level. Twelve distinct tones are available for controlling up to twelve functions.

As discussed previously, the interconnect package establishes telephone-to-radio patches. To provide only the dispatchers and after-hours supervisors with the capability to initiate calls, the automatic answering unit available from companies such as Monroe

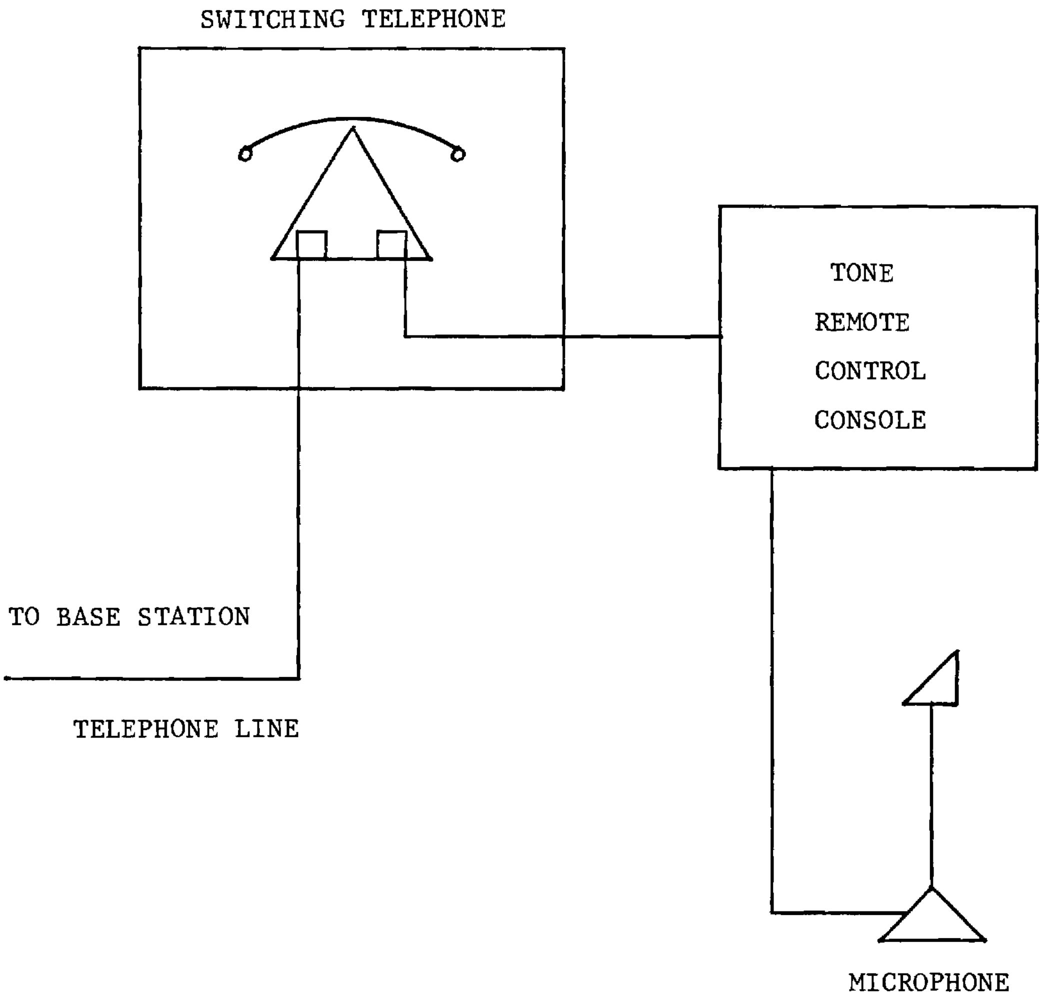

Figure 4-1. Control Point Hardware for Base Station Access.

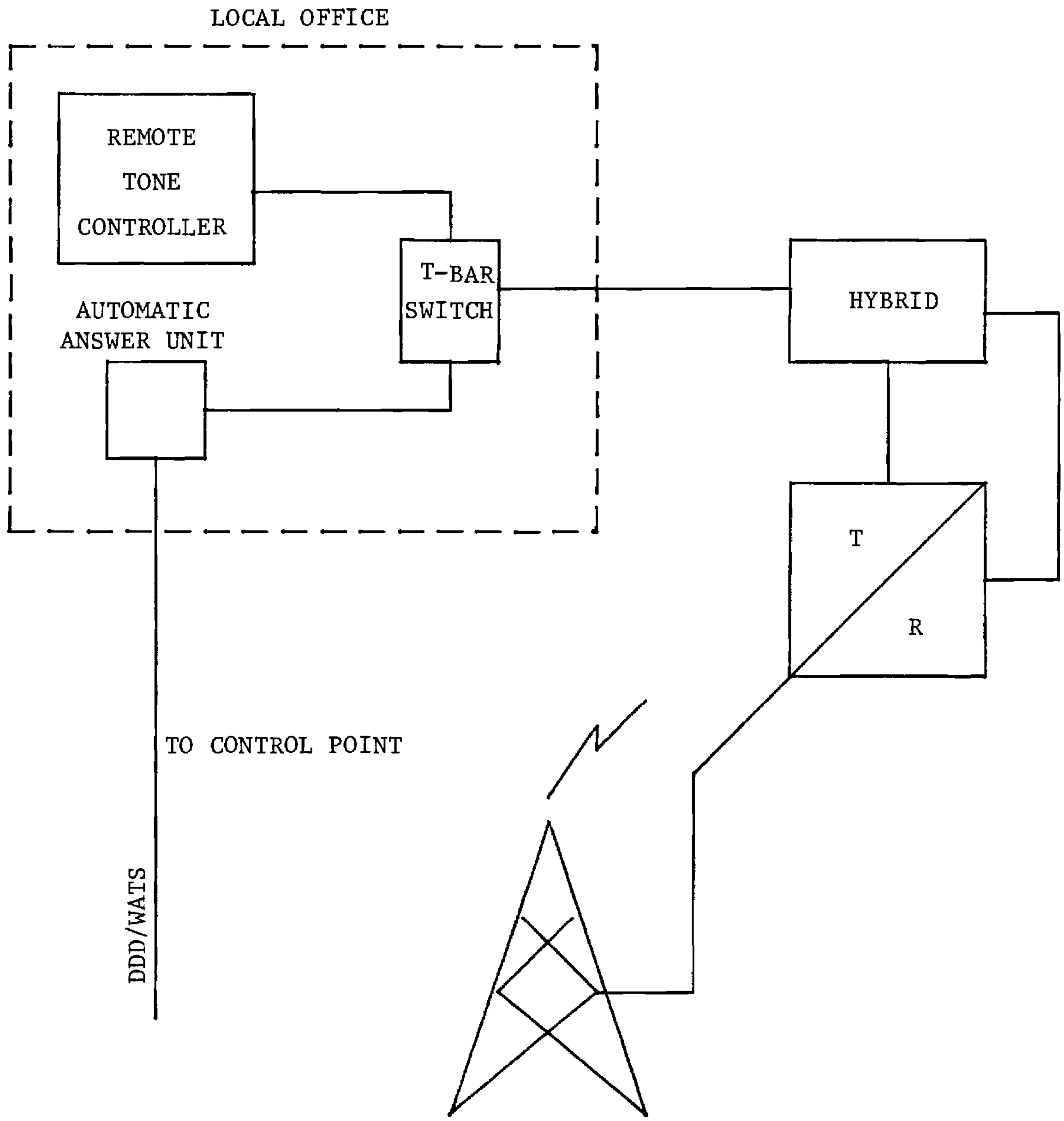

Figure 4-2. Local Office Hardware.

Electronics are appropriate. Costs for such patches are about $200 per transmitter.

To provide field personnel with the call initiation capability, a similar patch is required. Both patches plus a time-out option are available from DSI for about $618 per transmitter. The option causes the unit to essentially answer the incoming call, and after a tone burst cue the dispatcher then has 4 seconds in which to transmit additional tones. Upon requests, DSI can incorporate all necessary components into one box to effect both patches for ease of installation.

A manual switch is provided to switch from local to remote operation. When the switch is in either the local or remote position of operation, the other operation is disabled; therefore, the local dispatcher must throw this switch when he leaves for the day to enable remote operation of the base station.

At the base station, the hybrid junction provides for a two-wire to four-wire interface to integrate the transmitter and receiver to the control/audio line.

4.2 Selective Calling

Volunteer Electric has expressed the desire to selectively communicate with individual personnel on-call in their respective service areas. Discussed below is a technique for accomplishing this task. For interfacing simplicity, General Electric hardware will be used in the discussion.

4.2.1 Implementation

Selective calling can be implemented readily with additional hardware that interfaces with the hardware discussed above in Section 4.1. Additional hardware for generating control tones and interfacing with the telephone line via the base station remote controller will be necessary at the Decatur office, the answering service, and the after-hours supervisors' homes. Personnel on-call will have to have portable receivers or transceivers with tone decoders. No additional hardware will be needed at the base station.

Once the communication link into the field has been established as described in Section 4.1, selective calling involves the generation of a distinct tone sequence particular to an individual receiver or transceiver. Using this technique, only one particular transceiver or receiver will respond, leaving the other tone-activated receivers or transceivers silent.

Hardware for the selective calling technique will be discussed in detail below.

4.2.2 Control Point Hardware

At each control point (Decatur office, answering service, and after-hours supervisors' homes), a tone encoding unit and an adapter cable with a microphone interface connnection are necessary for implementation of selective calling.

The adapter cable with microphone connection links the tone encoding unit to the audio input of the tone remote controller. These devices are illustrated in Figure 4-3, and their costs are listed in Table 5-2.

4.2.3 Field Hardware

The field hardware required includes tone-activated portable receivers (for one-way) or transceivers with supporting accessories and possibly encoders. Accessories should include a swivel mount and belt, charger, and flexible antenna. As mobile units may be accessed via radio broadcast, no decoders are necessary for the trucks.

Should VEC elect to provide personnel with the call-initiation capability, encoders are available which can be installed in the unit so the case and chargers may still be used. The transceivers in the mobile

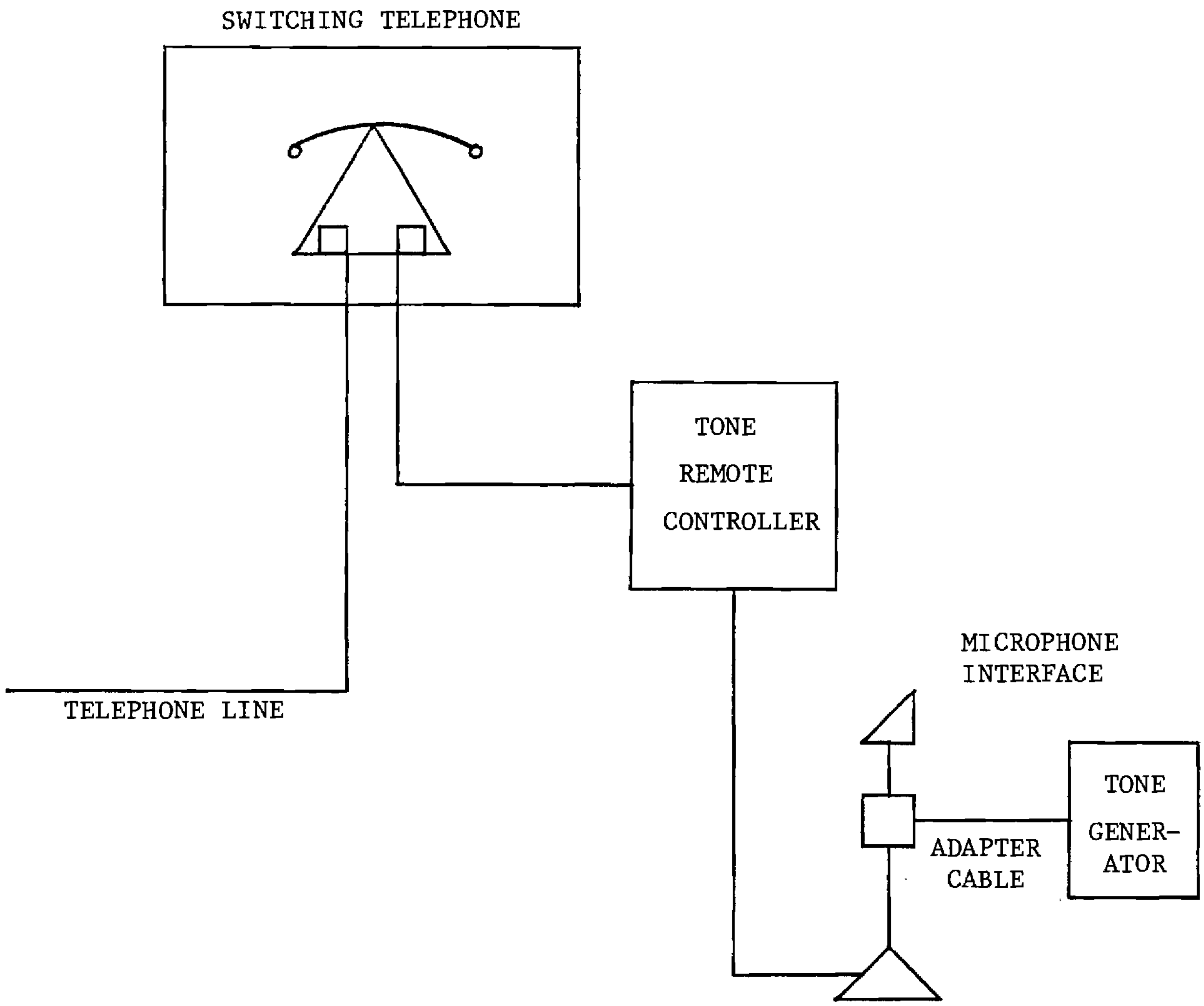

Figure 4-3. Control Point Hardware for Base Station Access and Selective Calling.

units can be encoder-equipped by replacing the present microphone with one which has an embedded encoder.

In some cases, specific transmitter coding can be provided in the units for no extra charge. For the unit from DSI, service personnel would key the sequence of tones and the "*" to activate a specific transmitter. Then, through the patch discussed previously, he or she would hear a dial tone and would call into the Decatur or answering service dispatcher through one of the inbound WATS numbers. Field personnel may disrupt traffic by hitting a transmitter's specific tone code then "#".

Installation of all units is straightforward and can be performed by VEC technicians.

5. SYSTEM COST SUMMARY

System costs will be presented in three categories: telephone costs, answering service costs, and hardware costs.

5.1 Telephone Costs

Telephone costs are summarized in Table 5-1. Two inbound and two outbound WATS lines already exist at the Decatur office, but prices are included in the table in case time limitations are exceeded or more lines are needed in the future. Two "off-premise" extensions are envisioned from the Decatur office to the answering service at this time, but up to four can be accommodated by the answering service without increasing their monthly fee. Two or three "Circle 40" calling services are envisioned for customer access to the local offices (automatically patched through to Decatur or the answering service after normal operating hours). However, as discussed previously, the number depends on the results of a study by South Central Bell regarding loads in those areas.

5.2 Answering Service Charges

Answering service with two-way paging from 11 P.M. to 8 A.M. Monday through Friday and 24-hour service on weekends and holidays, as provided by McKann Answering Service of Athens, is estimated to cost $1,084 per month. Estimates are delineated in Table 5-3.

5.3 Hardware Costs

Individual hardware units and their associated costs are summarized in Table 5-2. Hardware costs are also broken down into subsystems so that overall system changes can be readily cost assessed. The subsystems are organized as follows: Decatur office, answering service, after-hours supervisors' homes, local offices (presently with D.C. control of base station), local offices (presently with tone control of base station), and field hardware. The number of subsystems envisioned for the proposed

TABLE 5-1

TELEPHONE COSTS

ITEM	COMPANY	MODEL	COST
"OFF-PREMISE" EXTENSION BETWEEN DECATUR AND McMANN ANSWERING SERVICE	SOUTH CENTRAL BELL 1900 WINSTON ROAD KNOXVILLE, TN 37919	-	$105.10 PER MONTH PLUS $905.85 ONE-TIME INSTALLATION CHARGE PER EXTENSION
"CIRCLE 40" CIRCLE CALLING SERVICE	SOUTH CENTRAL BELL 1900 WINSTON ROAD KNOXVILLE, TN 37919	-	$12.20 PER HOUR AND $.195 FOR EACH ADDITIONAL MINUTE PLUS ONE-TIME SERVICE ORDER CHARGE OF $16.00
STATEWIDE WATS LINE OUT OF DECATUR (INBOUND OR OUTBOUND)	SOUTH CENTRAL BELL 1900 WINSTON ROAD KNOXVILLE, TN 37919	FULL BUSINESS DAY	$1,035 PER MONTH FOR THE FIRST 240 HOURS AND $4.30 FOR EACH ADDITIONAL HOUR PER MONTH, PLUS A ONE-TIME INSTALLATION CHARGE OF $75.00
		MEASURED TIME	$335 PER MONTH FOR THE 15 HOURS AND $20.00 FOR EACH ADDITIONAL HOUR PER MONTH PLUS A ONE-TIME INSTALLATION CHARGE OF $75.00
AUTOMATIC ANSWERING UNIT WITH RECORDING	SOUTH CENTRAL BELL 1900 WINSTON ROAD KNOXVILLE, TN 37919	-	$27.00 PER MONTH, PLUS $45.00 INSTALLATION PER UNIT (ONE UNIT NEED PER LINE).

TABLE 5-2

INDIVIDUAL HARDWARE COSTS

ITEM	COMPANY	MODEL	COST
TONE REMOTE CONTROLLER	GENERAL ELECTRIC	MASTER REMOTE CONTROLLER	$850
ADAPTER CABLE WITH MICROPHONE INTERFACE	GENERAL ELECTRIC	4061	$21
TWO TONE SEQUENTIAL ENCODER	GENERAL ELECTRIC	101 x 1	$472
MANUAL SWITCH	T-BAR	5723	$120
AUTO ANSWER UNIT	MONROE ELECTRONICS	922	$198
INTERCONNECT PKG	DATA SIGNAL, INC	RAP200 (TEL-RADIO PATCH) MDA-200 TELCO ANSWER W/ CODEOUT OPTION (RADIO-TEL PATCH)	$329 $159 $150
HYBRID JUNCTION (2-4 WIRE)	LORRAINE TELEPHONE ELECTRIC	TS5022 LIST 1	$92
BASE STATION DC TO TONE CONTROL CONVERSION			$92
PERSONNEL TRANSCEIVER	GENERAL ELECTRIC	PE64TBLBBX	$1260
TRANSCEIVER ENCODER	DATA SIGNAL, INC	SME-BE	$36
SWIVEL MOUNT WITH BELT	GENERAL ELECTRIC	4481	$12
CHARGER	GENERAL ELECTRIC	361 L31AX	$107
FLEXIBLE ANTENNA	GENERAL ELECTRIC	4430	$29
ENCODER WITH MICROPHONE FOR TRUCKS	DATA SIGNAL, INC	DATA CODER 5	$59
ONE-WAY POCKET PAGERS	GENERAL TELEPHONE	-	$26 PER MONTH
ALERT ONLY POCKET PAGERS		-	$20 PER MONTH

TABLE 5-3

ANSWERING SERVICE ESTIMATE*

CANDIDATE	SERVICE	COST
McMann Answering Service 612 Ingleside Avenue Athens, TN 37303	M-F: 11 p.m.-8 a.m. plus 24 hours on weekends and and holidays. One-way paging and answering services.	$842 per month
	Same as above for hours between 5 p.m.-8 a.m. M-F, 24 hours on weekends and holidays.	$1,340 per month
	M-F: 11 p.m.-8 a.m. plus 24 hours on weekends and holidays for two-way paging and answering services.	$1,084 per month
	Same as above for M-F: 5 p.m.-8 a.m. and 24 hours on weekends and holidays.	$1,573 per month

*Answering service estimates are based on one-year contracts renegotiable on the anniversary of each contract date. Estimates are based on a load factor as discussed in this report and provision for 1-4 pairs of incoming lines from the Decatur office. All necessary radio equipment and pagers would be purchased and provided by the utility.

system is in parentheses. Under each subsystem, the number and type of hardware for each subsystem is listed. After each subsystem listing, a unit subsystem total is made. After all unit subsystem totals have been made, a total system hardware cost is provided. This organization is presented below.

SYSTEM HARDWARE COSTS

(1) Decatur office

	(1)	tone remote controller	$850
	(1)	D.C.-to-tone base station conversion	800
	(1)	two-tone sequential encoder	472
	(1)	adapter cable	21
	(1)	automatic answering unit (1-way patch)	198
or	(1)	interconnect package (2-way patch)	618
	(1)	T-Bar switch	120
	(1)	hybrid junction	92
		unit total	$2553 or $2973

(1) Answering service hardware

(1)	tone remote controller	$850
(1)	two-tone sequential encoder	472
(1)	adapter cable	21
	unit total	$1343

(12) After-hours supervisors' homes

(1)	tone remote controller	$850
(1)	two-tone sequential encoder	472
(1)	adapter cable	21
	unit total	$1343

(5) Local office (presently with D.C. control of base station)

	(1) tone remote controller	$850
	(1) D.C.-to-tone base station conversion	800
	(1) two-tone sequential encoder	472
	(1) adapter cable	21
	(1) automatic answering unit	198
or	(1) interconnect package	618
	(1) T-Bar switch	120
	(1) hybrid junction	92
	unit total	$2553 or $2973

(2) Local office (presently with tone control of base station)

	(1) two-tone sequential encoder	$472
	(1) adapter cable	21
	(1) automatic answering unit	198
or	(1) interconnect package	618
	(1) T-Bar switch	120
	(1) hybrid junction	92
	unit total	$ 903 or $1323

Field hardware

(22) Hand-held

(1) personnel transceiver	$1260
(1) transceiver encoder	36
(1) swivel mount with belt	12
(1) flexible antenna	29
(1) charger	107
unit total	$1444

(97) Truck unit

Encoders with microphones unit total $59

TOTAL SYSTEM HARDWARE COSTS

		(1-Way Patch)		(2-Way Patch)
(Decatur office unit total) x 1	=	$ 2,553	or	$ 2,973
(Answering service unit total) x 1	=	$ 1,343		
(After-hours supervision)* 3 x 4	=	$ 16,116		
(Local office [D.C.]) x 5	=	$ 12,765	or	$14,865
(Local office [tone]) x 2	=	$ 1,806	or	$ 2,646
(Field hardware)	=	$ 30,976	or	$31,768
(hand-held) x 22	=	$ 30,976	or	$31,768
(mobile) x 97	=			$ 5,723
*Total hardware cost		$ 65,559	or	$75,434

*NOTE: Total does not include automatic answering devices for incoming customer call. Costs for such devices are listed in Table 5-1.

DESIGN OF AN INTEGRATED COMMUNICATIONS SYSTEM TO SUPPORT CENTRALIZED DISPATCHING, SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) AND CUSTOMER-RELATED DATA PROCESSING

By

R.W. Rice, Project Director
C. Gilbreath-Frandsen

Prepared For

VOLUNTEER ELECTRIC COOPERATIVE
P.O. Box 277
Decatur, Tennessee 37322

Under

Project A-2463

June 1981

GEORGIA INSTITUTE OF TECHNOLOGY

Engineering Experiment Station
Atlanta, Georgia 30332

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1. Requirements

The system sought by VEC must serve a variety of purposes including financial data transmission, real time data and control (SCADA) transmission, voice commuications for customer compliant/service calls, office-to-office communications, load management, and centralized dispatching. The requirements for each of these activities will be discussed in detail below.

1.1 Financial Data Transmission

The financial data used by the various VEC offices to interact with customers is presently transmitted from a central computer at Decatur to terminals at the other VEC offices. Table 1-1 summarizes the number of terminals in use at the various offices. Each of the remote displays will necessitate a voice-grade channel for data communications.

1.2 Real-Time Data and Control (SCADA)

It has been indicated by VEC personnel that the integrated communications system should support a supervisory control and data acquisition (SCADA) system to collect real-time system data and to permit centralized control of the power network. Most of the currently available SCADA systems permit multi-drop communications between the central control processor and the remote terminal units located in the substations. In other words, a single communications line can be used to communicate with several substation units. Given this capability and the organization of VEC's service area into districts, a reasonable approach is to have all of the substations in a given district connected to the central processor in Decatur by a single communications channel. Thus, three microwave channels would be required - one to Jamestown, one to Crossville, and one to Cleveland. The substations in the River Basin District would be connected directly to the Decatur office, and would, therefore, not require a microwave channel.

TABLE 1-1

DATA COMMUNICATION SUMMARY

VEC District/Sub-Office	Type Computer Service	Number of Terminals	Number of Displays
Decatur	Univac 90/30	3	4
Georgetown	----	1	1
Cleveland	----	1	1
Benton	----	1	1
Spring City	----	1	1
Crossville	----	2	1
Monterey	----	1	1
Jamestown	----	1	1
Byrdstown	----	1	1

It is also suggested that provision be made for each of the district offices to have a terminal connected to the SCADA system allowing as a minimum, each district office to have available the real-time control data for its own service area. Should VEC at a future date elect to have distributed control at the district level, this could be achieved in most systems with no modification to the communications facility. Each remote SCADA terminal will necessitate a single voice-grade channel on the microwave systems.

1.3 Voice Communications

Voice communications between Decatur and the various district offices and service centers is also required. Three distinctly different categories of activity area anticipated and each would require a separate channel on the microwave system. First, there is the operational communications between the remote offices and Decatur which pertain to actual system status and operation. This communications is of a high priority nature and should not be blocked due to line unavailability. Second, there is the externally generated communications entering the district office via dial telephone line destined for the control center in Decatur. Two major activities fall into this category - service complaints directed to the central dispatcher and calls from utility personnel wishing either to talk to the dispatcher or to go through the dispatcher to the VHF radio system. Third, there is a communications requirement for a link between Decatur and the base radio unit located at the district offices. This connection would permit dial access to the district office radio by utility personnel, and it would permit mobile/hand-held units to initiate contact with any party accessible through the PBX at the central site. Figure 1-1 and 1-2 summarize the voice communications line requirements district offices and service centers, respectively.

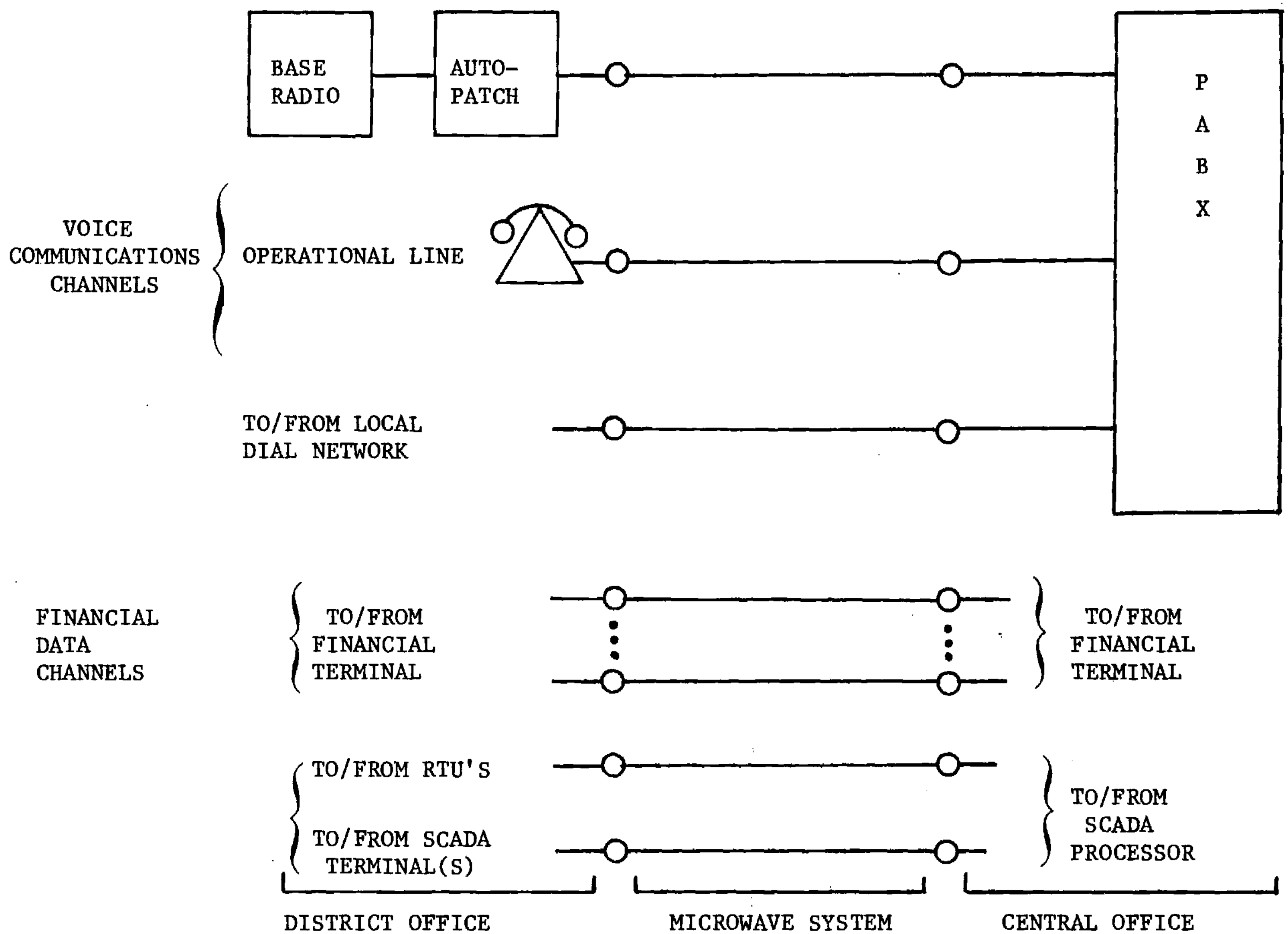


Figure 1-1 Microwave channel requirements for a district office.

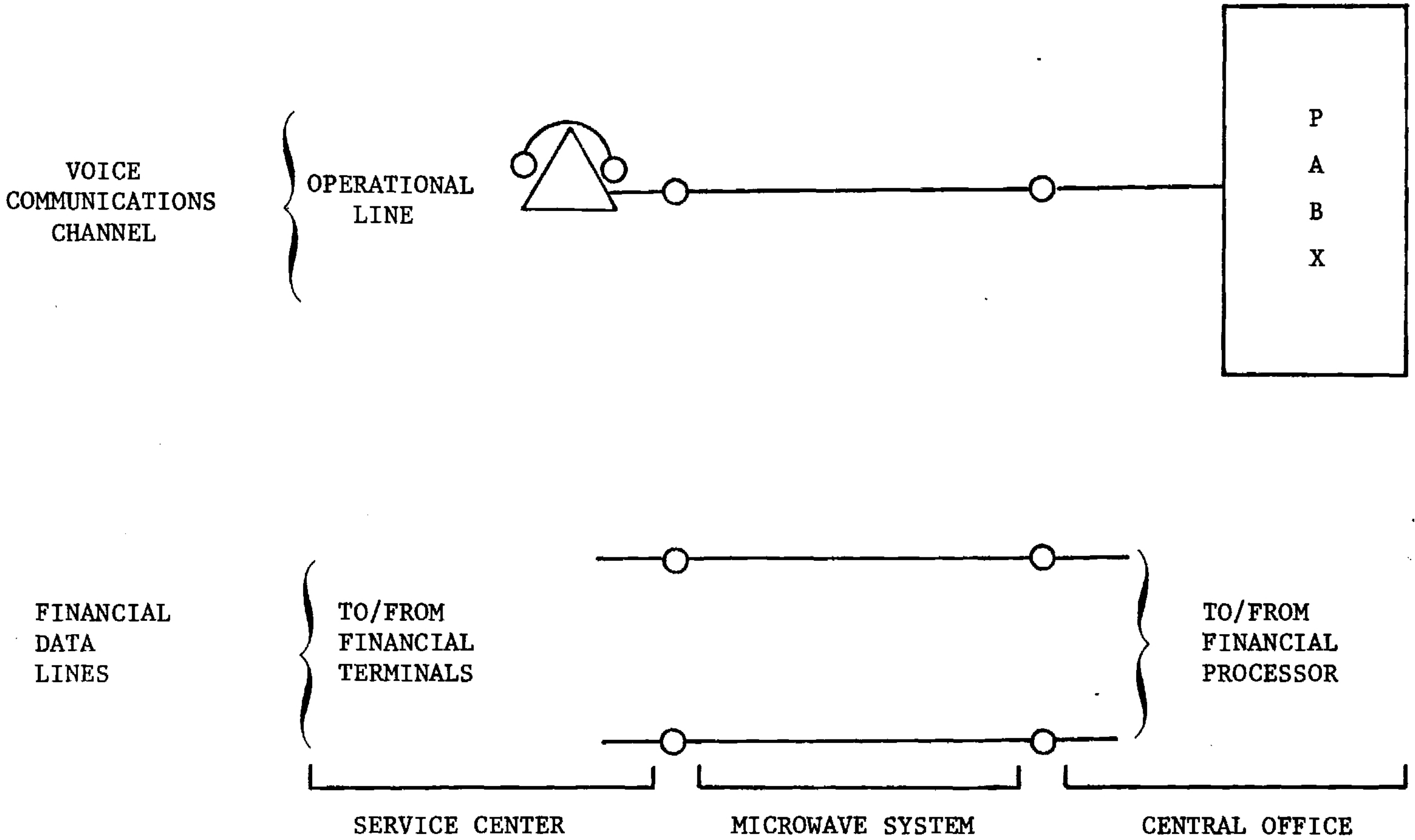


Figure 1-2 Microwave channel requirements for a service center.

1.4 Load Management

It is understood that VEC anticipates involvement in a load management program in the near future; however, the details of the program are not known with any certainty at this time. For communications system planning purposes, it will be assumed a structure of the type shown in Figure 1-3 will be employed. This configuration is chosen both because it is effective in most applications and because it tends to produce the minimum communications requirement. Also, it should be pointed out that there are a variety of manufacturers which produce load management systems which utilize this configuration. A key feature of the multi-drop configuration is the communication interface unit which possesses sufficient intelligence to respond only to messages directed to it on the common communications channel.

1.5 Requirements Summary

Table 1-2 summarizes the number of voice-grade channels required at each office to support the previously described functions.

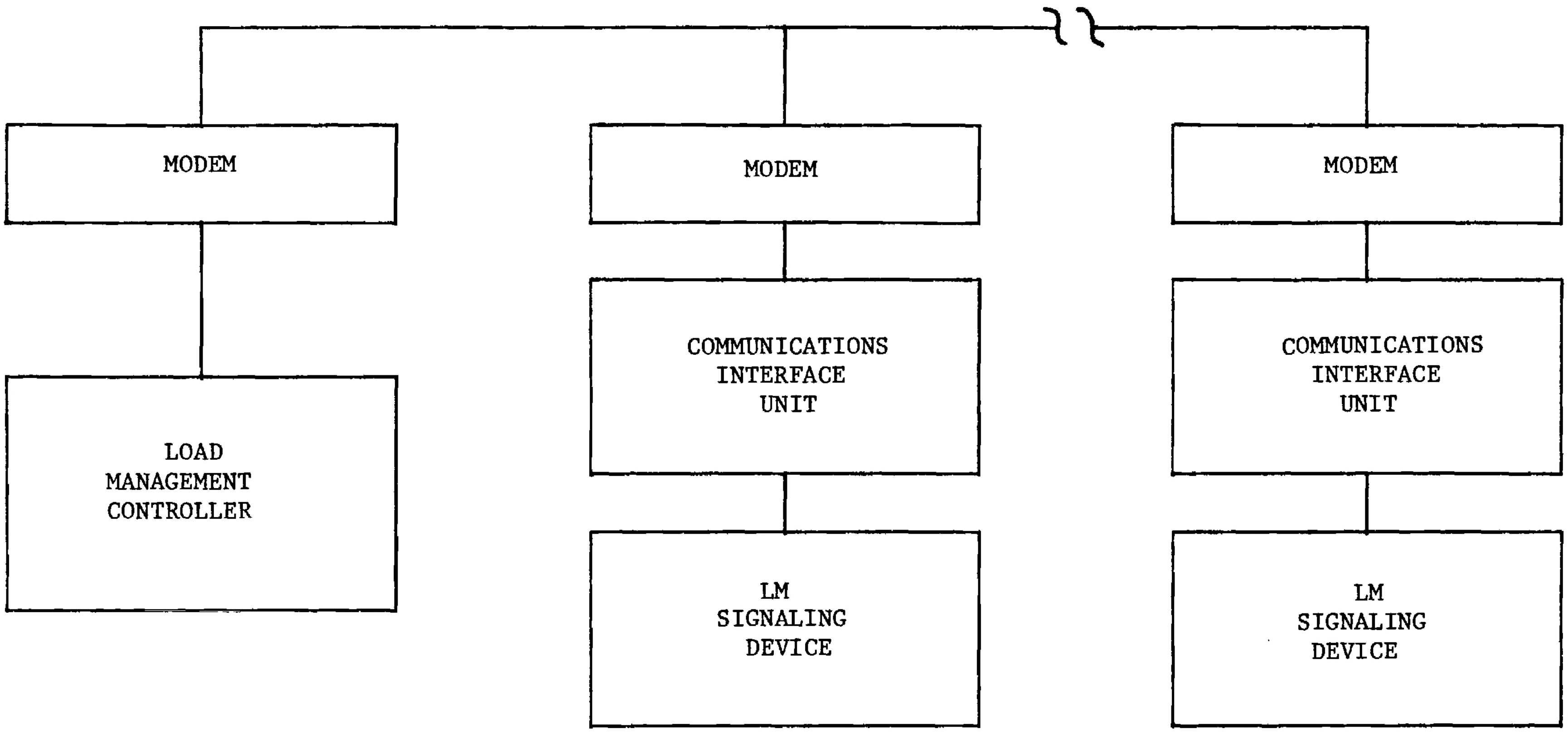


Figure 1-3. Possible structure for load management communications.

TABLE 1-2

SUMMARY OF VOICE-GRADE CHANNEL REQUIREMENTS

	SERVICE				
OFFICE	FINANCIAL DATA	SCADA	VOICE	GROWTH	LM
BENTON	1	0	1	1	1
BYRDSTOWN	1	0	1	0	1
CLEVELAND	1	2	3	2	1
CROSSVILLE	2	2	3	1	1
DECATUR	3	-	-	-	1
GEORGETOWN	1	0	1	1	1
JAMESTOWN	1	2	3	1	1
MONTEREY	1	0	1	1	1
SPRING CITY	1	0	1	1	1

2. Microwave System Design

This section presents a design of a microwave system for Volunteer Electric Cooperative to support voice, data, and control communications. Four criteria have dominated design considerations and they are:

(1) each link has been designed for 24 channel capacity as a minimum to accommodate both present needs and future expansion capacity.

(2) each link has been designed to achieve a reliability of at least 99.999% which translates to an outage time of approximately 5.3 minutes per year.

(3) the system design has specifically minimized the use of common carrier lines in order to keep the responsibility for system operation within VEC.

(4) tower heights have been minimized where possible to reduce costs, and where possible, the tall towers required for the microwave system have been positioned so that they can also serve the VHF radio system.

Figure 2-1 shows a line diagram of the entire network, and detailed descriptions of each link are provided below.

Tower sites selected for the following analysis are included in Appendix B of this report and include site coordinates and ground elevations. Although not used here, tower locations that may also be considered are those where towers already exist. Leasing tower space may prove more cost effective than erecting a structure. A list of existing facilities with space available for leasing and respective contacts are included in Appendix C.

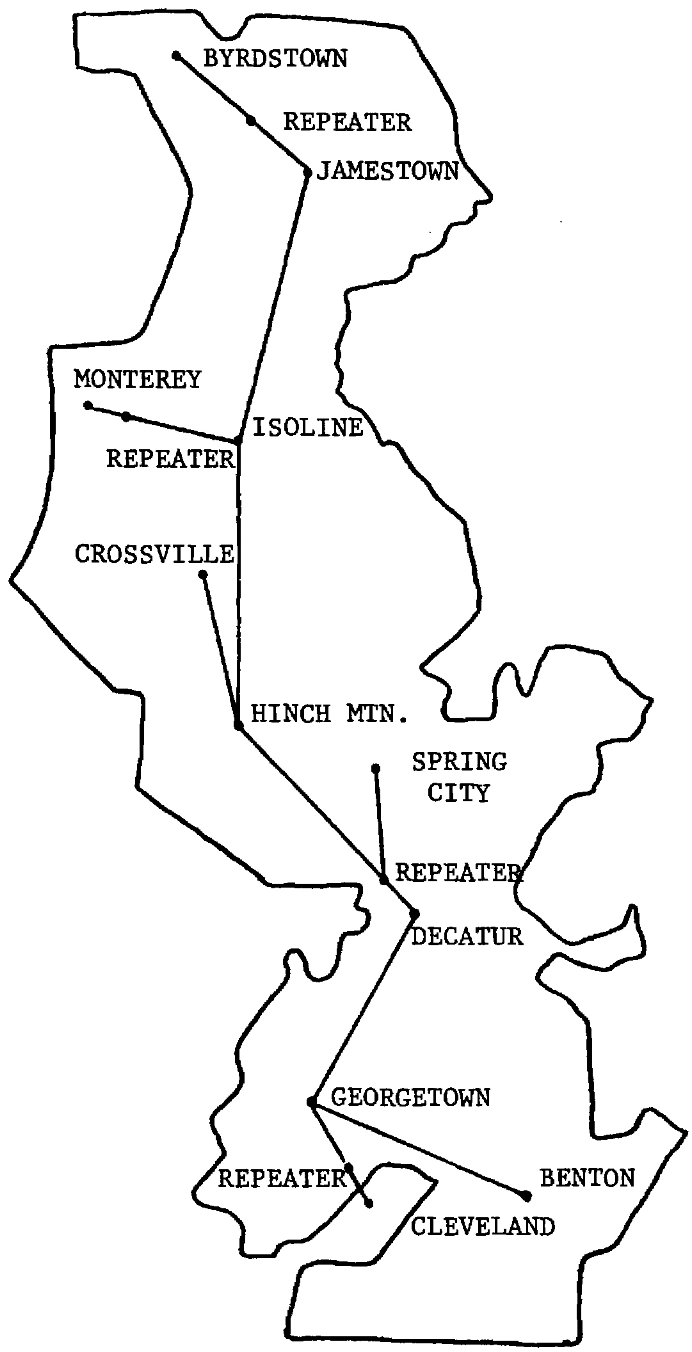


Figure 2-1. Line diagram of recommended microwave system.

2.1 Decatur-to-Georgetown (White Oak Mountain)

Figure 2-2 shows the path profile between the VEC office and a point on White Oak Mountain near Georgetown. The White Oak Mountain site was chosen because of its potential to also provide good VHF radio coverage in the area. The figure may also be used to determine required antenna elevations at both ends of the path. Two factors dominate antenna height considerations-vegetation/building heights and required Fresnel zone clearance. For this design, we have assumed that vegetation/building heights will not exceed 15 meters, and we have also assumed a clearance criteria of 0.6 times the radius of the first Fresnel zone.

Using the above criteria one can determine from Figure 2-2 that the antennas at both ends of the link should be mounted 20 meters above ground level.

The process of determining required transmitter power, antenna gain, and receiver noise figure involves calculating various parameters and choosing others to be consistent with readily available hardware.

We begin the process by evaluating the path propagation loss. At a frequency of 2.1 GHz, the path loss is 129.1 dB. Additional losses incurred include transmission line losses and the splitting/combining losses associated with each transmitter-receiver pair. In this case 20 m of transmission line is used at each site, and a commonly available line has a loss of 4 dB per 100 m at this frequency for a total line loss of 1.6 dB. The splitting/combining loss at each site is commonly three dB, and for both sites this amounts to six dB. Thus, the total system loss is 136.7 dB.

Next, the required signal level at the receiver must be determined. To do this, one must specify the following parameters.

F: receiver noise figure, which is typically 5 dB.

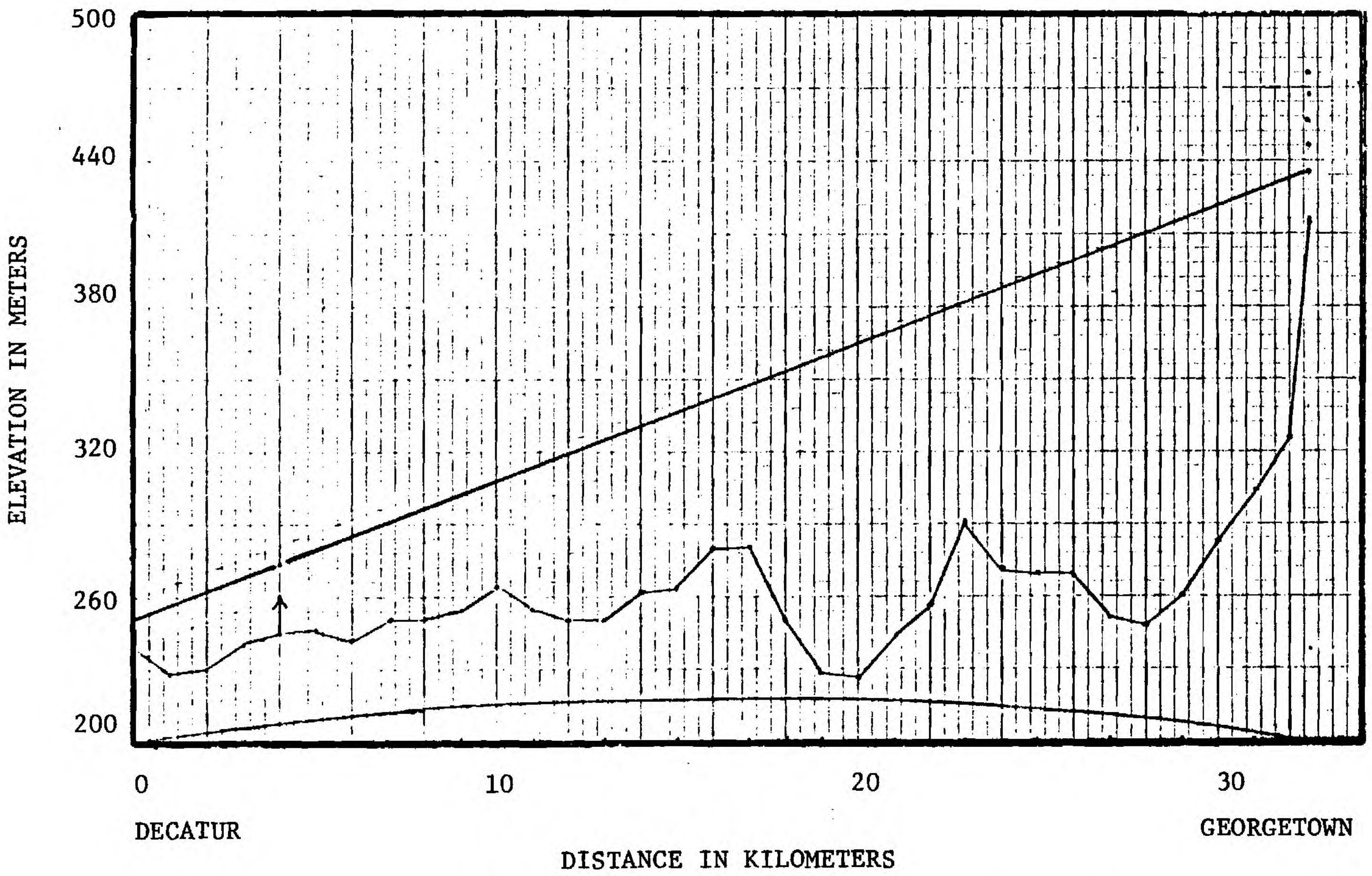


Figure 2-2. Path profile for Decatur-Georgetown link.

df: peak per channel deviation, assumed current practice for a 24 channel 800 F9 service.

dBrnc0: equivalent noise power in top channel assumed to be 55 which is standard in industrial systems.

Given these values, one may determine that the required signal level at the receiver is -93.7 dBm.

For a link of this length, 32.6 km, a fade margin of approximately 35 dB is required to achieve a link reliability of 99.999%. Thus, the nominal signal level at the receiver is 35 dB above -93.7 dBm or -58.7 dBm.

Knowing the total system loss, 136.7 dB, and the nominal signal level, one can show that the sum of the transmit level in dBm, the transmitter antenna gain in dBi, and the receiver antenna gain in dBi is 78. The objective is to use the smallest antenna possible to meet the link requirements so that the wind load or the supporting tower will be as small as possible. A limiting constraint here is imposed by the Federal Communications Commission which requires that in noncongested areas the maximum 3-dB beamwidth for the antenna be eight degrees (Category B). Theoretically, the eight degree beamwidth should be achievable with a four foot diameter parabolic reflector. In practice, a six foot diameter reflector is typically offered for Category B service, and such an antenna is assumed in this case. Typically, a six foot, wire grid parabolic antenna will offer 29 dB of gain. If such an antenna is used at both ends of the link, then a 20 dBm (0.1 watt) transmitter will be required.

A similar analysis process has been carried out for each link. For all other links, the results are summarized. A detailed explanation is offered only if some significant variation is involved. The salient features of this link are summarized below.

Decatur Site:

Transmitter: 24 channel FM/FDM,
20 dBm output

Antenna: 6 ft grid dish (Category B), 29 dBi gain (nominal), mounted at 20 meter level

Transmission line: unpressurized coaxial,
4 dB/100 m maximum loss

Receiver: 24 channel FM/FDM,
5 dB noise figure

Georgetown Site:

Transmitter: 24 channel FM/FDM,
20 dBm output

Antenna: 6 ft. grid dish (Category B),
29 dBi gain, mounted
at 20 meter level

Transmission line: unpressurized coaxial,
4 dB/100 m
maximum loss

2.2 Georgetown-to-Cleveland

The path profile for the Georgetown to Cleveland link is presented in Figure 2-3. Notice that the Cleveland Airport is located very close to the VEC office in Cleveland. The Federal Communications Commission (FCC) and Federal Aviation Administration (FAA) impose restrictions on tower erections near airports. In particular, a 25-to-1 slope must be observed for any erection within 1.52 kilometers (5,000 feet) of the nearest point of the airport runway. In this case, tower erection at the Cleveland office would have to be less than 20 meters in height to obtain the FAA approval process for construction. Such a restriction precludes a direct path between Georgetown and Cleveland, but as shown in Figure 2-3, a two-hop link will work.

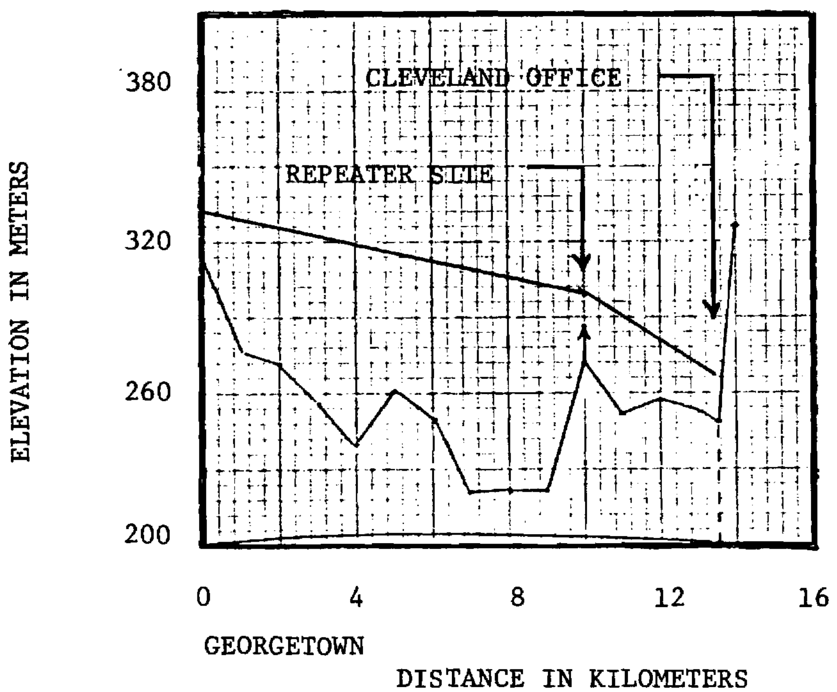


Figure 2-3. Path profile for Georgetown-Cleveland link.

The repeater envisioned for this link is a small, lower power, active repeater with a gain of 45 dB.

The features of the end-points and the repeater site are summarized below.

Georgetown site:

Transmitter: 24 channel FM/FDM,
20 dBm output

Antenna: 6 ft grid dish (Category B),
29 dBi gain, mounted at
20 meter level

Transmission line: unpressurized coaxial,
4 dB/100 m maximum loss

Repeater site:

Gain: 45 dB (minimum)

Output: 10 dBm (minimum)

Antenna: 2-6 ft grid dish (Category B),
29 dBi gain, mounted at
20 meter level

Cleveland site:

Transmitter: 24 channel FM/FDM,
20 dBm output

Receiver: 24 channel (max) FM/FDM,
5 dB noise figure

Antenna: 6 ft grid dish (Category B),
29 dBi gain, mounted at
20 meter level

2.3 Georgetown-to-Benton

The Georgetown-to-Benton link is a simple single-hop path with the antenna heights determined by tree and Fresnel zone clearance requirements as shown in Figure 2-4. The end-point characteristics are shown below.

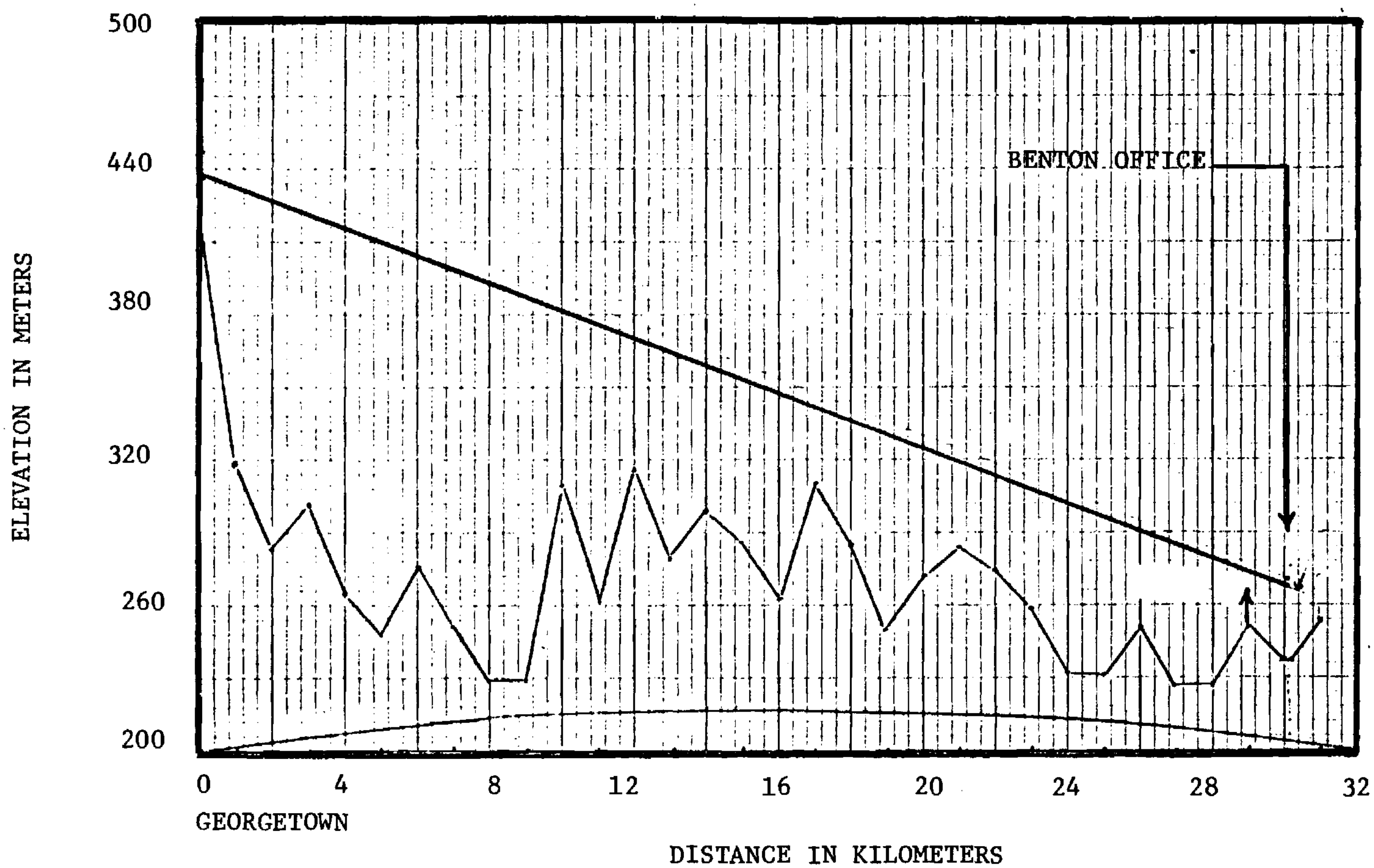


Figure 2-4. Path profile for Georgetown-Benton link.

Georgetown:

Transmitter: 24 channel FM/FDM,
20 dBm output

Receiver: 24 channel FM/FDM,
5 dB noise figure

Transmission line: unpressurized coaxial,
4 dB/100 m attenuation (max)

Antenna: 6 ft. grid dish (Category B),
29 dBi gain, mounted at
20 meter level

Benton:

Transmitter: 24 channel FM/FDM,
20 dBm output

Receiver: 24 channel FM/FDM,
5 dB noise figure

Transmission line: unpressurized coaxial,
4 dB/100 m attenuation (max)

Antenna: 6 ft grid dish (Category B),
29 dBi gain, mounted at
30 meter level

2.4 Decatur-to-Hinch Mountain

This link as a whole is intended to serve as half of an over-the-mountain path. As may be seen from Figure 2-5, a direct path between the top of Hinch Mountain and the Decatur office of VEC is possible; however, such a link would require a 55 meter tower at the Decatur site. This tower height was judged to be excessive, so an approach using a repeater located approximately 2 km from the Decatur office was chosen. The technical details for this link are summarized below.

Decatur site:

Transmitter: 24 channel FM/FDM,
20 dBm output

Receiver: 24 channel FM/FDM,
5 dB noise figure

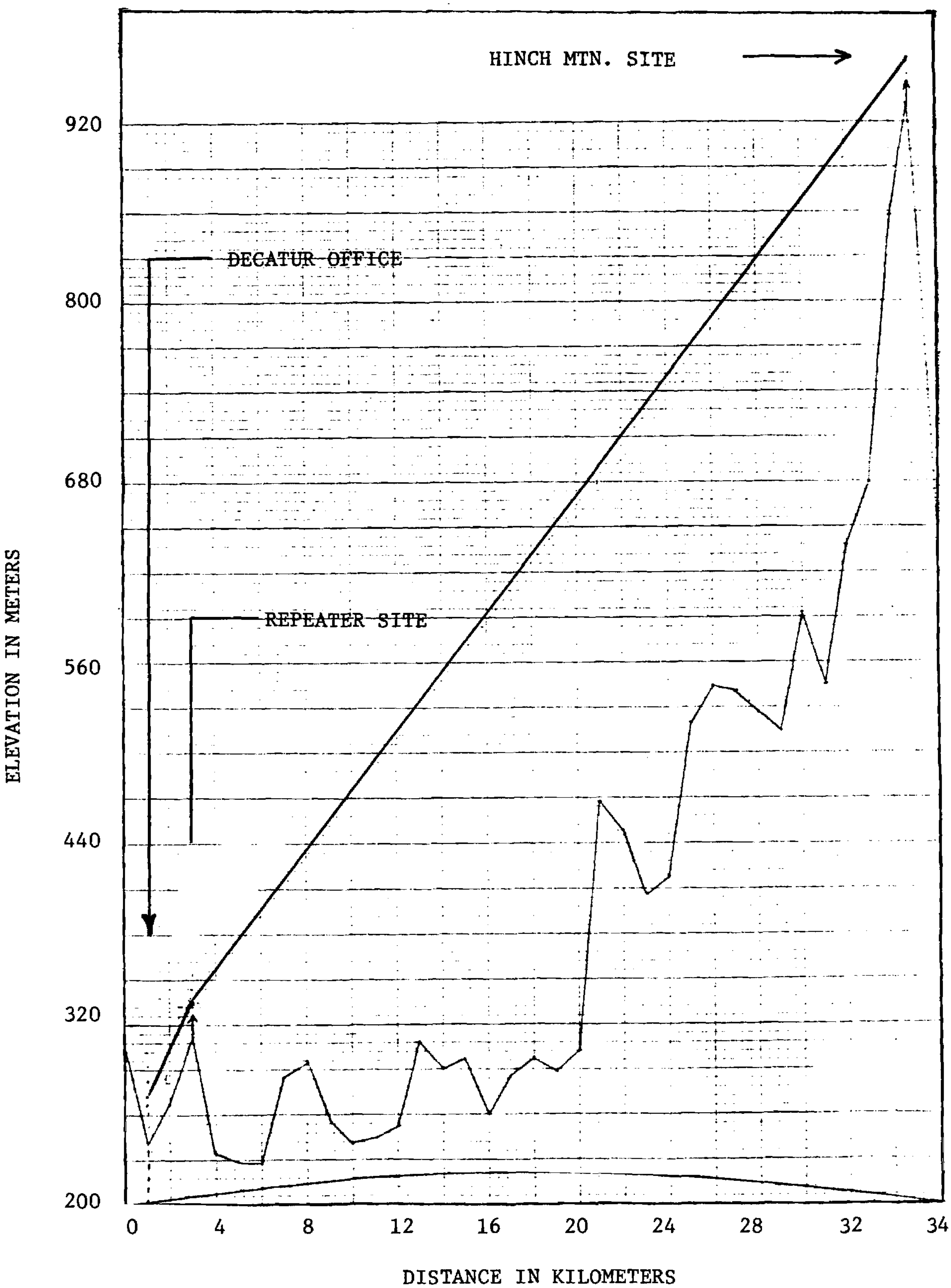


Figure 2-5. Path profile for Decatur Hinch Mtn. link.

Transmission line: unpressurized coaxial,
4 dB/100 m attenuation (max)

Antenna: 6 ft grid dish (Category B),
29 dBi gain, mounted at
30 meter level

Repeater site:

Gain: 45 dB (minimum)

Output: 10 dBm (minimum)

Antenna: 2-6 ft. grid dish (Category B),
29 dBi gain, mounted at
20 meter level

Hinch Mountain site:

Transmitter: 24 channel FM/AFM,
30 dBm output

Receiver: 24 channel FM/FDM,
5 dB noise figure

Transmission line: unpressurized coaxial,
4 dB/100 m attenuation (max)

Antenna: 6 ft grid dish (Category B),
29 dBi gain, mounted at
20 meter level

2.5 Decatur Repeater-to-Spring City

From Figure 2-6, one can observe that the path between Decatur and Spring City is subject to several pronounced variations in elevation. These extreme variations make a direct link possible only through extremely tall towers at both ends of the path. This was judged to be undesirable; therefore, the repeater site for the Decatur-to-Hinch Mtn. link was chosen for a repeater on the Spring City link. The technical parameters for such a link are provided below.

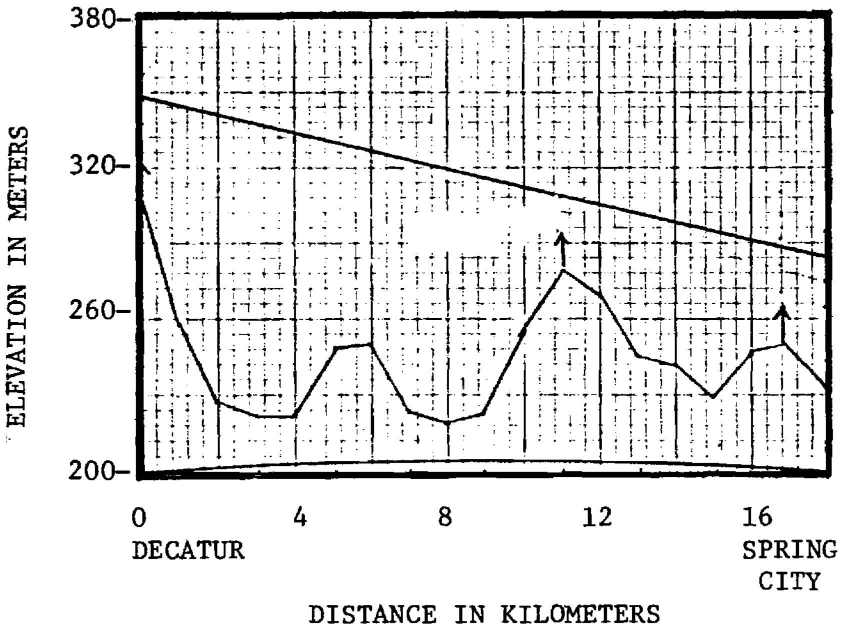


Figure 2-6. Path profile for Decatur-Spring City link

Decatur site:

Transmitter: 24 channel FM/FDM,
20 dBm output

Receiver: 24 channel FM/FDM,
5 dB noise figure

Transmission line: unpressurized coaxial,
4 dB/100 m
attenuation (max)

Antenna: 6 ft. grid dish (Category B)
29 dBi gain, mounted at
30 meter level

Decatur repeater site:

Gain: 45 dB (minimum)

Output: 10 dBm (minimum)

Antennas: 2-6 ft. grid dish (Category B),
29 dBi gain, mounted
at 40 meter level

Spring City site:

Transmitter: 24 channel FM/FDM,
20 dBm output

Receiver: 24 channel FM/FDM,
5 dB noise figure

Transmission line: unpressurized coaxial,
4 dB/100 m attenuation (max)

Antenna: 6 ft grid dish (Category B),
29 dBi gain, mounted at
50 meter level

2.6 Hinch Mountain-to-Crossville

The path profile for this link is provided in Figure 2-7, and from the figure, it is evident that a direct single-hop connection is possible. The details for this link are provided below.

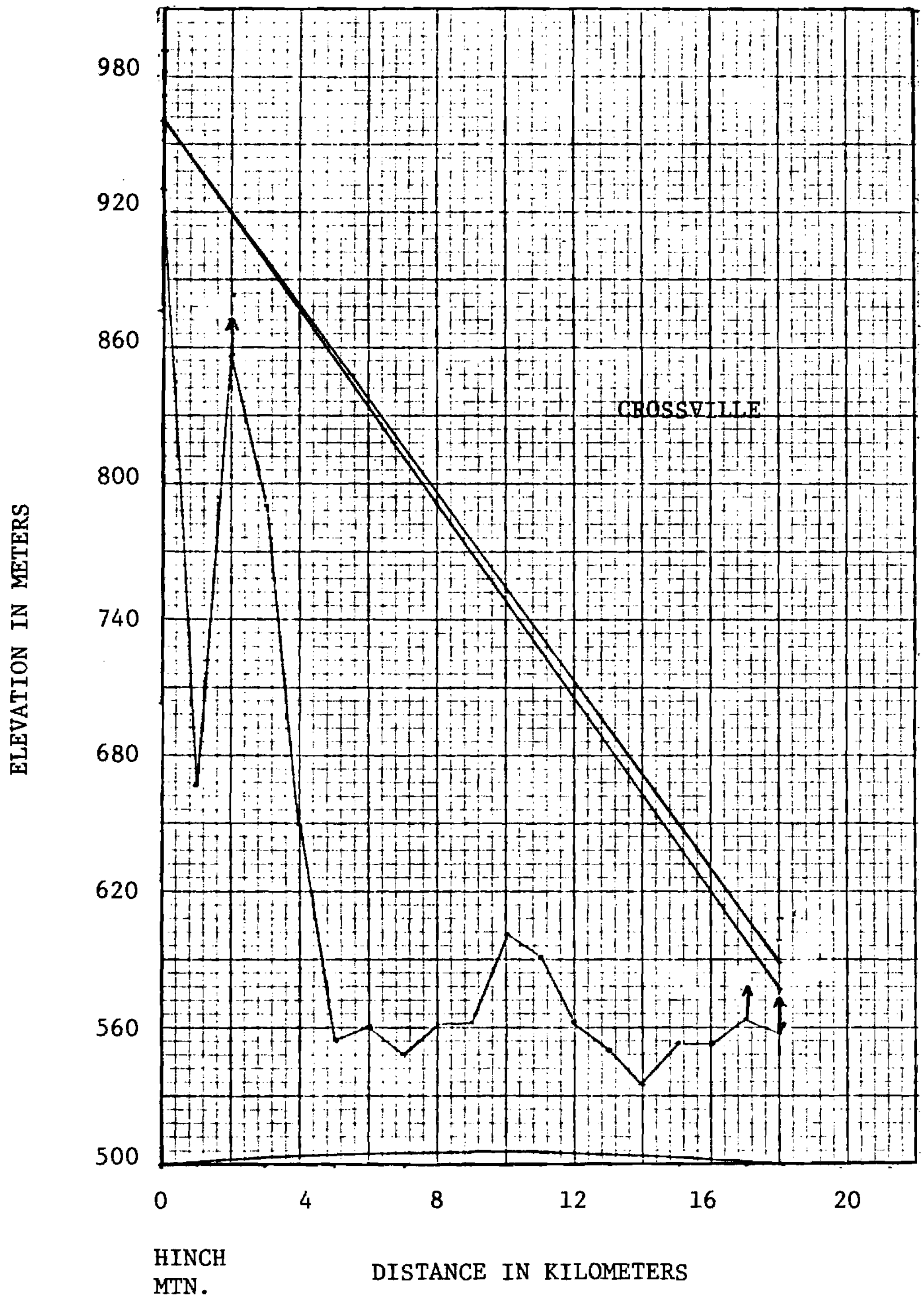


Figure 2-7. Path profile for Hinch Mtn-Crossville link.

Hinch Mountain:

Transmitter: 24 channel FM/FDM
20 dBm output

Receiver: 24 channel FM/FDM,
5 dB noise figure

Transmission line: unpressurized coaxial,
4 dB/100 m attenuation (max)

Antenna: 6 ft. grid dish (Category B),
29 dBi gain, mounted at
20 meter level

Crossville:

Transmitter: 24 channel FM/FDM,
20 dBm output

Receiver: 24 channel FM/FDM,
5 dB noise figure

Transmission line: unpressurized coaxial,
4 dB/100 m attenuation (max)

Antenna: 6 ft. grid dish (Category B),
29 dBi gain, mounted at
20 meter level

2.7 Hinch Mountain-to-Isoline

The profile for this path is presented in Figure 2-8. As indicated in the figure, a direct single-hop connection is possible, and the details for this link are presented below.

Hinch Mountain site:

Transmitter: 24 channel FM/FDM
30 dBm output

Receiver: 24 channel FM/FDM
5 dB noise figure

Transmission line: unpressurized coaxial,
4 dB/100 m attenuation (max)

Antenna: 6 ft grid dish (Category B)
29 dBi gain, mounted at
30 meter level

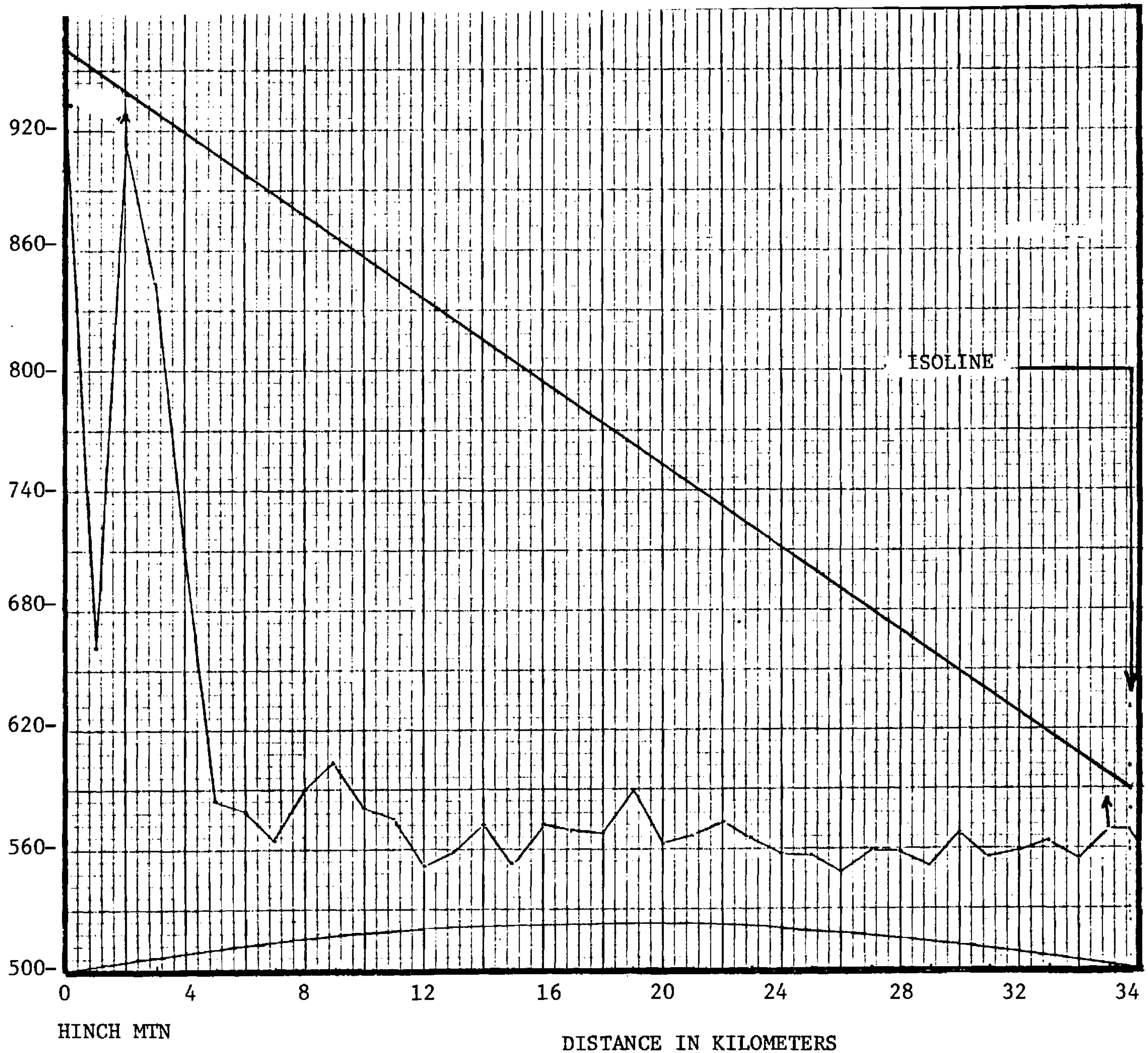


Figure 2-8. Path profile for Hinch Mtn-Isoline link.

Isoline site:

Transmitter: 24 channel FM/FDM
30 dBm output

Receiver: 24 channel FM/FDM,
5 dB noise figure

Transmission line: unpressurized coaxial,
4 dB/100 m attenuation (max)

Antenna: 6 ft grid dish (Category B),
29 dBi gain, mounted at
20 meter level

2.8 Isoline-to-Monterey

Figure 2-9 depicts the profile for the Isoline-to-Monterey link. Notice that a direct single-hop link is possible if the antenna at Isoline is at the 45 meter level and the antenna at Monterey is at the 60 meter level. The latter seemed to be excessively high; therefore, expensive for the link in question. As an alternative, a two-hop connection is proposed with a repeater on a crest approximately 1.4 km from Monterey. The technical details for this link are presented below.

Isoline site:

Transmitter: 24 channel FM/ADM,
20 dBm output

Receiver: 24 channel FM/FDM,
5 dB noise figure

Transmission line: unpressurized coaxial,
4 dB/100 m attenuation (max)

Antenna: 6 ft. grid dish (Category B),
29 dBi gain, mounted at
45 meter level

Monterey repeater site:

Gain: 45 dB (minimum)

Output: 10 dBm (minimum)

Antenna: 2-6 ft. grid dish (Category B),
29 dBi gain, mounted at
30 meter level

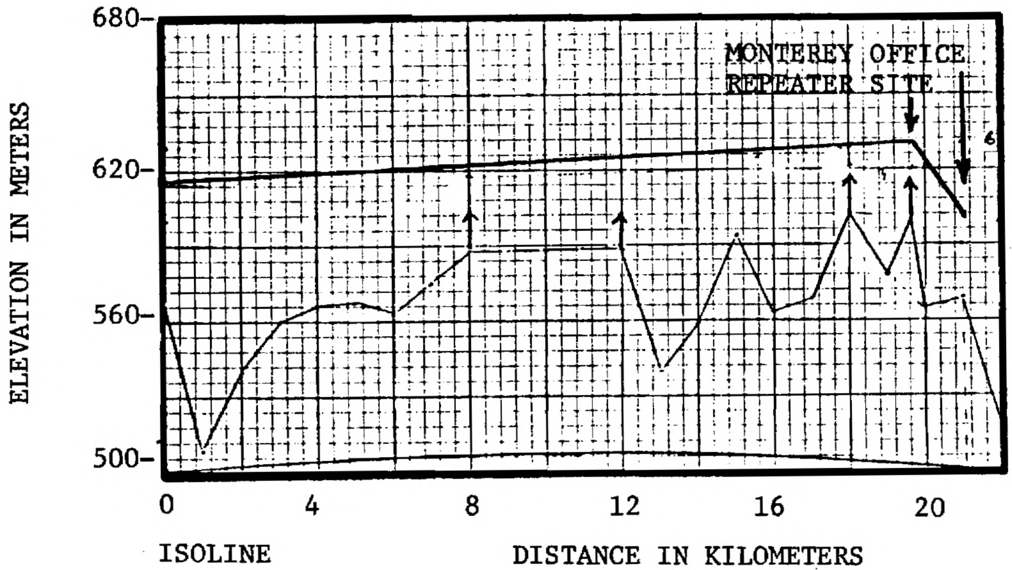


Figure 2-9. Path Profile for Isoline-Monterey Link.

Monterey site:

Transmitter: 24 channel FM/FDM,
20 dBm output

Receiver: 24 channel FM/FDM,
5 dB noise figure

Transmission line: unpressurized coaxial,
4 dB/100 m attenuation (max)

Antenna: 6 ft. grid dish (Category B),
29 dBi gain, mounted at 20 meter level

2.9 Isoline-to-Jamestown

A direct single-hop link between Isoline and Jamestown is possible and recommended. The profile for this path is provided in Figure 2-10, and the details for this link are provided below.

Isoline site:

Transmitter: 24 channel FM/FDM,
30 dBm output

Receiver: 24 channel FM/FDM,
5 dB noise figure

Transmission line: unpressurized coaxial,
4 dB/100 m attenuation (max)

Antenna: 6 ft. grid dish (Category B),
29 dBi gain, mounted at
50 meter level

Jamestown site:

Transmitter: 24 channel FM/FDM,
30 dBm output

Receiver: 24 channel FM/FDM,
5 dB noise figure

Transmission line: unpressurized coaxial,
4 dB/100 m attenuation (max)

Antenna: 6 ft. grid dish (Category B),
29 dBi gain, mounted at
45 meter level

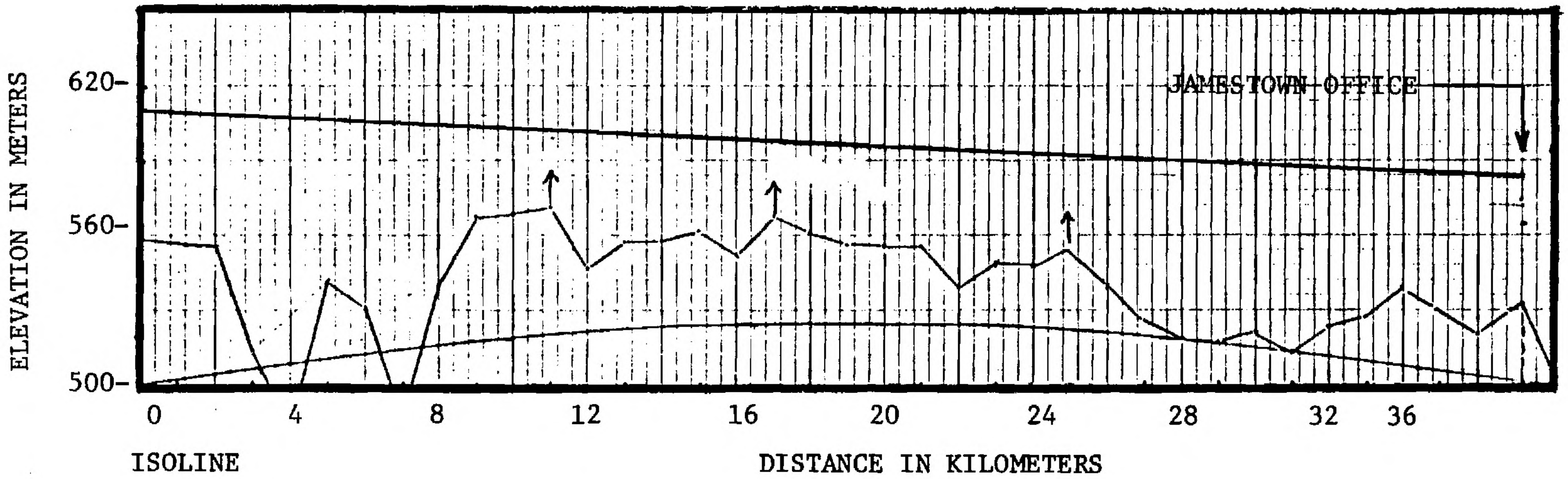


Figure 2-10. Path Profile for Isoline-Jamestown Link.

2.10 Jamestown-to-Byrdstown

The terrain between Jamestown and Byrdstown is very irregular and there is a noticeable shift in average elevation between these points. These factors make a direct single-hop link highly impractical; therefore, a two-hop link is suggested as shown in the terrain profile of Figure 2-11. The details for this link are provided below.

Jamestown site:

Transmitter: 24 channel FM/FDM,
20 dBm output

Receiver: 24 channel FM/FDM,
5 dB noise figure

Transmission line: unpressurized coaxial,
4 dB/100 m attenuation (max)

Antenna: 6 ft grid dish (Category B),
29 dBi gain, mounted at
30 meter level

Repeater site:

Gain: 45 dB (minimum)

Output: 10 dBm (minimum)

Antennas: 2-6 ft grid dish (Category B),
29 dBi gain, mounted
30 meter level

Byrdstown site:

Transmitter: 24 channel FM/FDM,
20 dBm output

Receiver: 24 channel FM/FDM,
5 dB noise figure

Transmission line: unpressurized coaxial,
4 dB/100 m attenuation (max)

Antenna: 6 ft. grid dish (Category B),
29 dBi gain, mounted at
20 meter level.

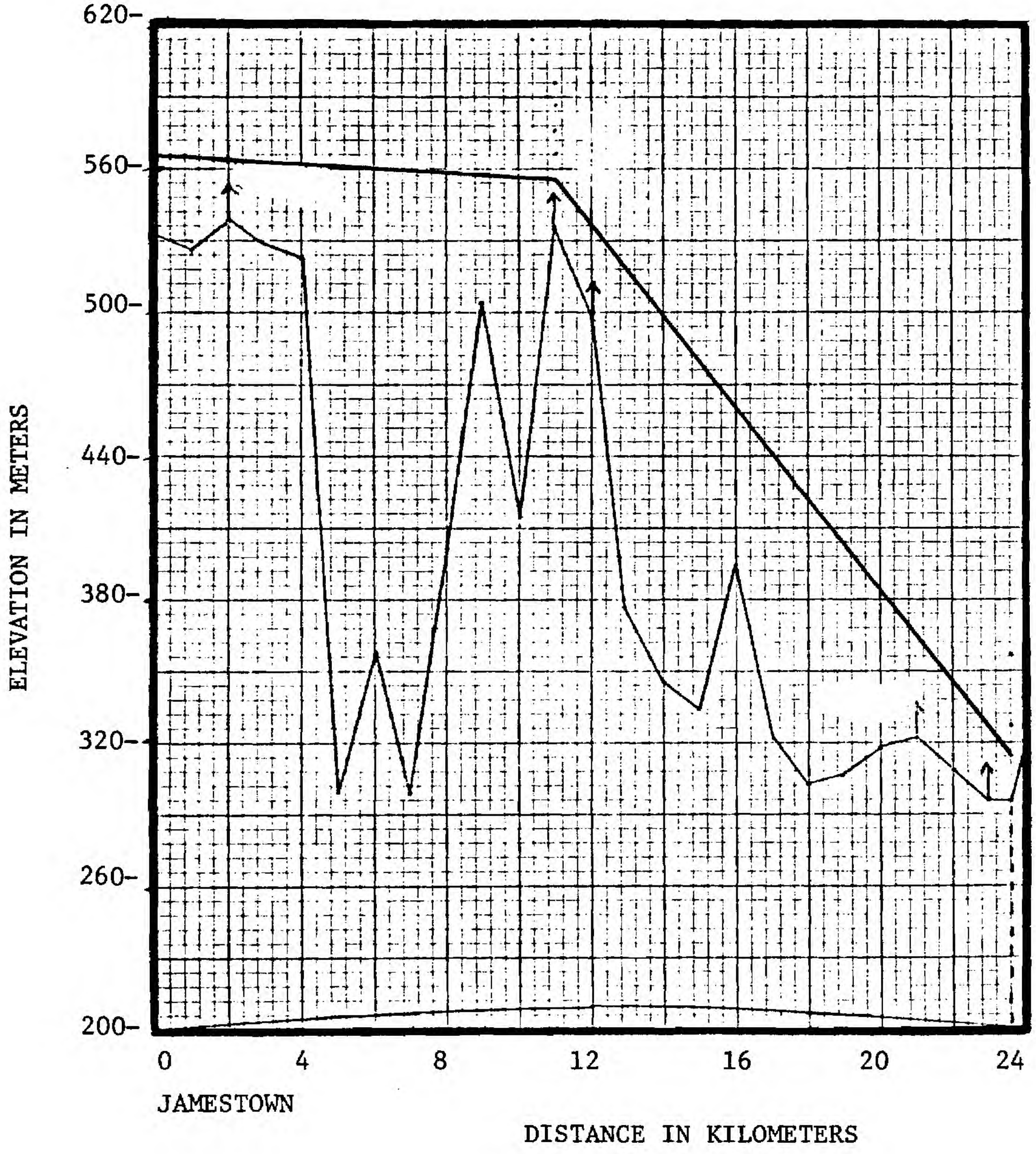


Figure 2-11. Path Profile for Jamestown-Byrdstown Link.

2.11 Channel Plan

The discussion and design analysis done in the preceding sections have assumed a maximum capacity of 24 channels. With a specific microwave geometry now determined and the channel requirements defined in Table 1-2, one can now specify an actual channel plan for the various links. Such a plan appears in Figure 2-12.

2.12 Microwave System Cost Estimate

The material presented in Sections 2.1 through 2.11 define the technical attributes of the different microwave links. Those attributes are summarized in Table 2-1. Using the data in Table 2-1, cost estimates for the various sites have been prepared, and those estimates are presented in Table 2-2. As used in Table 2-2, non-redundant means that no hardware item is duplicated to increase reliability. On the other hand, the hot-standby configuration duplicates the radio frequency (RF) portion of each station in such a way that degraded performance or outright failure of the primary RF equipment leads to automatic switch over to redundant the RF system. The hot-standby approach significantly reduces the likelihood that all communications between two points will be lost; however, since the individual channel equipment is not back up, a single channel failure can still occur.

To put the cost figures of Table 2-2 into perspective, it is desirable to clearly identify what is covered in the cost estimates.

Most of the microwave sites are co-located with existing VEC offices; therefore, for those sites, no building or land costs have been included. The exceptions to this are the Cleveland Repeater, Decatur Repeater, Georgetown, Hinch Mountain, Isoline, Jamestown Repeater, and Monterey Repeater sites. Of this subset, those explicitly identified as repeaters use equipment which does not require additional housing; therefore, the costs for these sites does not include any building costs. The Georgetown, Hinch Mountain, and Isoline sites use equipment which requires indoor mounting to minimize the effects of temperature variations. Typically, such equipment works over a temperature range of

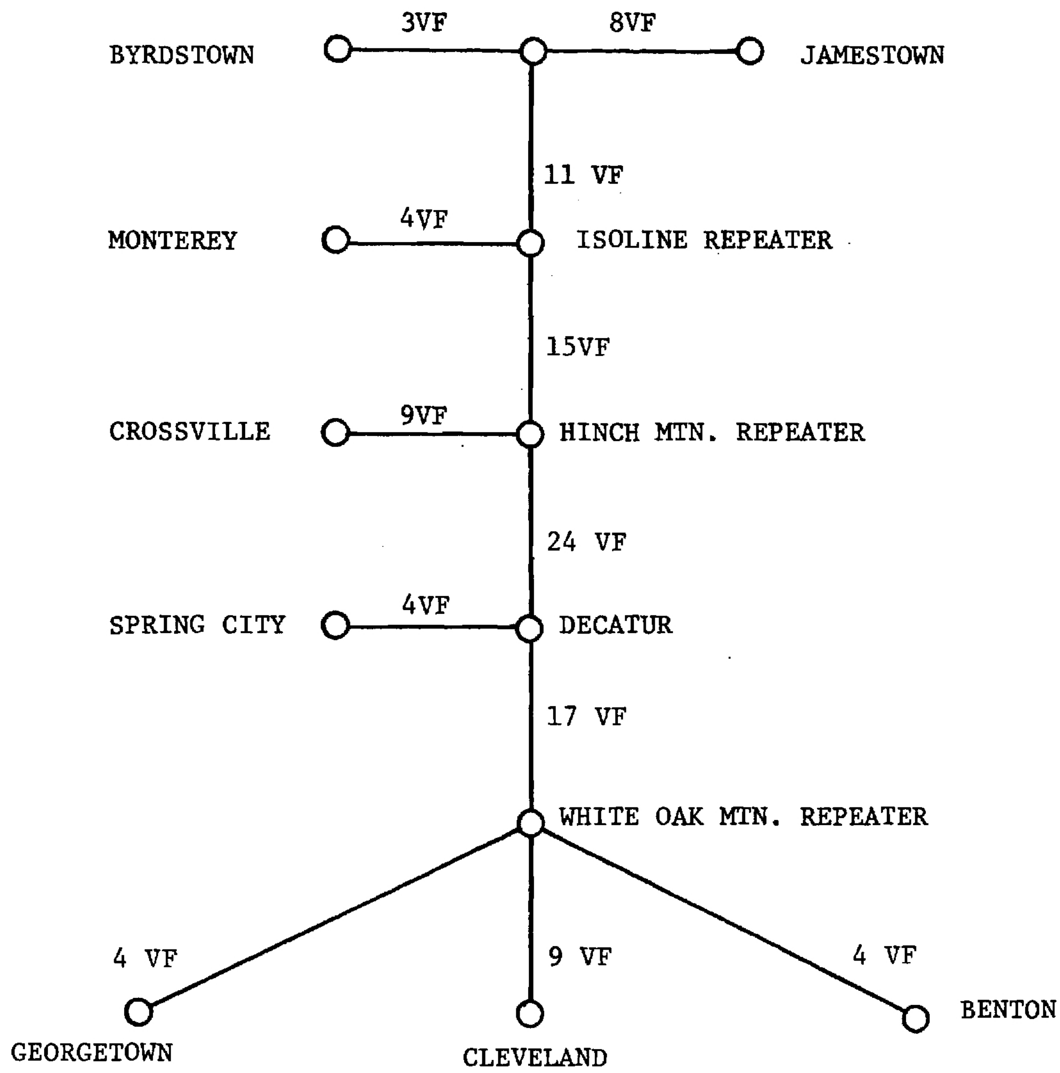


Figure 2-12. Channel plan for process node located at Decatur.

TABLE 2-1

MICROWAVE EQUIPMENT SUMMARY

SITE	TRANSMITTER/RECEIVER 20dBm	TRANSMITTER/RECEIVER 30dBm.	REPEATER	ANTENNA	TRANSMISSION LINE	TOWER	BASEBAND EQUIPMENT CHANNEL UNITS	BASEBAND EQUIPMENT SUPERVISORY EQUIPMENT	BASEBAND EQUIPMENT E & M	BASEBAND EQUIPMENT FOREIGN EXCHANGE
BENTON	1	-	-	1	35m.	30m.	3	1	1	0
BYRDSTOWN	1	-	-	1	25m.	20m.	3	1	1	0
CLEVELAND	1	-	-	1	25m.	20m.	8	1	2	1
CLEVELAND RPTR.	-	-	1	2	-	20m.	-	-	-	-
CROSSVILLE	1	-	-	1	25m.	20m.	9	1	2	1
DECATUR	3	-	-	3	85m.	30m.	40	3	11	3
DECATUR RPTR.	-	-	2	4	-	40m.	-	-	-	-
GEORGETOWN (WHITE OAK MTN.)	3	-	-	3	75m.	61m.	25	3	7	2
HINCH MTN.	1	2	-	3	85m.	61m.	46	3	12	4
ISOLINE	1	2	-	3	130m.	61m.	28	3	8	2
JAMESTOWN	1	1	-	2	85m.	45m.	8	2	2	1
JAMESTOWN RPTR.	-	-	1	2	-	61m.	-	-	-	-
MONTEREY	1	-	-	1	25m.	20m.	3	1	1	0
MONTEREY RPTR.	-	-	1	2	35m.	30m.	-	-	-	-
SPRING CITY	1	-	-	1	55m.	50m.	3	1	1	0

TABLE 2-2

MICROWAVE SITE COST ESTIMATE

SITE	CONFIGURATION NON-REDUNDANT	CONFIGURATION HOT-STANDBY
BENTON	$19,910	$24,910
BYRDSTOWN	17,303	22,303
CLEVELAND	19,838	24,838
CLEVELAND RPTR.	14,484	18,884
CROSSVILLE	20,444	25,444
DECATUR	63,316	78,316
DECATUR RPTR.	30,368	39,168
GEORGETOWN (WHITE OAK MTN.)	69,570	84,570
HINCH MTN.	86,030	101,030
ISOLINE	70,070	85,070
JAMESTOWN	35,077	45,077
JAMESTOWN RPTR.	29,600	34,000
MONTEREY	16,074	21,074
MONTEREY RPTR.	18,701	23,101
SPRING CITY	23,895	28,895
TOTALS	$534,680	$656,680

$0^{o}C$ to $50^{o}C$; therefore, it is possible that both heating and cooling may be required for the facility. The building cost estimate assumes a ten feet wide by ten feet deep structure of average height (approximately eight feet) with a construction cost of $60/square foot of floor space.

Obviously, each of the sites not co-located with a VEC office will require land acquisition. The amount of land to be acquired is a function of tower height, which in turn, determines the guy line placement. The following defines the minimum area required for tower guying at the non-office sites.

Office	Area Required (Minimum)
Cleveland Repeater	0.4 Acres
Decatur Repeater	1.5 Acres
Georgetown	3.0 Acres
Hinch Mountain	3 Acres
Isoline	3 Acres
Jamestown Repeater	3 Acres
Monterey Repeater	1 Acre

For this analysis, land costs were assumed to be $2,000 per acre.

The remainder of the cost associated with each site is attributable to hardware items such as transmitters, receivers, antennas, transmission lines, towers, and baseband equipment. For the baseband equipment estimate, each site was equipped with the number of channels indicated in Table 2-1. Also, a service channel was provided at each of the non-repeater sites to allow (1) voice communications for maintenance purposes between the remote microwave stations and the central microwave facility at Decatur, and (2) to allow alarm conditions such as station entry or transmitter failure at the remote microwave stations to be reported to the Decatur site automatically. The cost estimate also includes a ring supply at each end station, VEC office, to permit dial-up operation of the telephones in the remote offices.

One item of significance which has not been included in the cost estimates for the microwave stations is power costs. Obviously, for those stations co-located with VEC offices, this costs is primarily energy usage cost, and the microwave equipment does not consume significant amounts of power. The remote sites face another situation. It is assumed that use of ac power from the distribution grid would in most cases involve line installations of several kilometers in length. This could be a significant cost item; however, since this work would be done by VEC, we have left the determination of that cost to VEC.

For several of the remote sites there is an alternative to ac power - solar power with battery back-up. This approach is particularly attractive for those sites which are only RF microwave repeaters - the Cleveland repeater, the Decatur repeater, and the Monterey repeater. The power consumption at these sites is very small and readily met by a photovoltaic system. A typical price for a solar array and voltage regulator for the RF microwave repeaters is approximately $1700.

The cost information presented thus far addresses the question of how much would a microwave system cost but says nothing about the economic desirability of such a system. To determine the economic desirability of such a system, we shall compare the cost of a microwave system with the cost of the major alternative - leased telephone lines. For this comparison, we shall assume that unconditioned series 3000 lines are used.

Before proceeding with the cost comparison, it is necessary to determine one additional cost element for the microwave system-maintenance costs. Experience suggests that the primary component of maintenance cost will be labor; therefore, consideration must be given to the size of the microwave maintenance labor staff. For this analysis, it will be assumed that the maintenance support will consist of three technicians each contributing one-half of their time to microwave maintenance. Furthermore, it will be assumed that each technicians will be on stand-by duty for a minimum of 16 hours per week. Using a base labor cost of $11.00/hour and assuming that stand-by time is charged at

150% of the base rate, the annual microwave maintenance cost is approximately $75,000.

If a microwave system is acquired, it will most likely involve a loan for most, if not all of the principal. Table 2-3 shows the monthly payments for 100% financing of the microwave system at various interest rates assuming a 10 year payback period. The table also contains an entry for maintenance which is the monthly equivalent of labor cost.

Next, one must estimate the cost of an equivalent leased line network. The microwave system provides 37 channels with a total of 1674 channel miles. The channel termination change for a series 3000 line is $45.22/month. For 37 channels, this amounts to $1673/month. The mileage charge for series 3000 lines is $5.14/channel-mile resulting in a charge of $8604/month for 1674 channel-miles. The total telephone bill would thus be $10,277/mo. Notice that this number exceeds the hardware costs for all microwave configurations.

It appears that the microwave system maintenance cost is the deciding factor in the comparison between the microwave system and the telephone system. If one could obtain a service contract for microwave maintenance at an annual rate of approxmately $25,000, then several of the microwave configurations become cost competitive with the telephone system.

TABLE 2-3

MONTHLY COSTS FOR MICROWAVE SYSTEM

ITEM	LOAN INTEREST RATE 5%	7%	10%	15%
NON-REDUNDANT CONFIGURATION	$ 5,570	$ 6,015	$ 6,680	$ 7,800
MAINTENANCE	$ 6,250	$ 6,250	$ 6,250	$ 6,250
TOTAL	$11,820	$12,265	$12,930	$14,000
HOT - STANDBY CONFIGURATION	$ 6840	$ 7,388	$ 8,200	$ 9,580
MAINTENANCE	$ 6,250	$ 6,250	$ 6,250	$ 6,250
TOTAL	$13,090	$13,638	$14,450	$15,830

3. VHF Radio Communications

The VHF radio system currently used by VEC is experiencing two major problems - spotty coverage and interference as a result of unusual propagation phenomena. The spotty coverage problem can be readily explained by observing the base station locations and the height of the associated antennas. In most cases, the existing base station transmitters are co-located with VEC offices, the location of which was chosen more for customer/employee convenience than for radio coverage characteristics. Furthermore, the antenna heights range from 45 feet to 90 feet in a region where terrain variations of 1000 feet are common.

The key to correcting the spotty coverage problem is getting the fixed radio transmitter-receiver units to locations which dominate the regional terrain and to then use towers of reasonable height to get the antennas well above even the local terrain. In doing this, one has two options - the fixed transmitter-receiver units can be treated as remote base stations, or they can be treated as repeaters. If the remote base approach is taken, then a link between the local office(s) and the remote base site must be provided. Since our recommended design, in most cases, co-locates the remote radio equipment with the microwave equipment, this can be done; however, this approach would result in the placement of additional equipment at the remote site. From an operational standpoint, we believe that the remote units should be kept as simple as possible in order to reduce maintenance problems and delays; therefore, we recommend the repeater approach.

The next question to be addressed in configuring a VHF radio system is that of operating frequency. As noted earlier, VEC is experiencing interference with its present system, and is therefore motivated to seek a new and higher operating frequency to reduce or eliminate this problem. At present, there are three frequency ranges which have land mobile channels allocated for utilities. They are the 30-50 MHz range, the 153-173 MHz range, and the 451-467 MHz range. In general, the likelihood of unusually long distance propagation due to peaks in the 11 year sun spot cycle declines as the radio frequency increases; however, the current peak is quite unusual in supporting long distance propagation. For example, one utility in Georgia is frequently receiving strong signals from a taxi cab company in Montreal, Canada, even though the utility is operating in the 153-173 MHz range. Thus, in the current situation, it would appear that one would have to use the 451-467 MHz range to significantly reduce the likelihood of long distance interference.

A second factor favoring, if not dictating the 451-467 MHz range, as an alternative to present operation, is frequency availability. Current indications are that TVA and the utilities in cities such as Knoxville, Chattanooga, and Nashville are currently using virtually all of the 153-173 MHz channels available for utilities. Should VEC wish to explore the use of the 153-173 MHz range further, two options are still open.

The first option involves getting an organization currently licensed to operate in the 153-173 MHz range to permit co-channel operation on their frequency. If the co-channel approach is taken, VEC must, as a minimum, get any currently authorized channel user within 75 miles of the proposed VEC facility to agree to co-channel operation. Also, any such arrangement must be approved by the utility telecommunications coordinator (UTC). In our judgement, the likelihood of success using this approach is small.

The second option is to petition the FCC for a waiver which will allow the use of a frequency currently assigned to another service, non-utility, by VEC. Typically, to do this, one engages the services of a law firm specializing in FCC petitions to first determine if such a frequency is available in the area of interest and secondly, to conduct the legal discussions with the FCC should such a frequency be available. The likelihood of success using this approach is difficult to judge; however, the region in question is not highly developed; therefore, one would expect that frequencies generally allocated to the motion picture industry, the press, manufacturing, the petroleum industry, etc. may not be fully utilized.

Assuming that the frequency choice is between the 30-50 MHz range and the 451-467 range, our recommendation would be to use the 30-50 MHz range. The reason for this recommendation may be seen in Figures 3-1 and 3-2. Figure 3-1 shows the coverage areas for 38 MHz repeaters at six sites in VEC's service area. The coverage patterns shown define the area around a given repeater which may be accessed 90% of the time with a confidence of 90% assuming that both the fixed unit and the mobile unit are using 100 watt transmitters. Notice that the six sites provide coverage for virtually all of VEC's service area, and that four of the six sites are also microwave sites.

Figure 3-2 shows the coverage patterns for the same sites as indicated in Figure 3-1, but for an operating frequency of 160 MHz. Notice that the individual coverage areas are significantly reduced compared to the 38 MHz case. Even with these reductions, it appears that coverage is provided for most of VEC's service area. One noticeable coverage gap appears northeast of Decatur. This gap could be filled by a transmitter in the Sweetwater - Ten Mile area. Thus, six transmitter sites, two of which are not a part of the microwave network, could provide coverage for the service area.

Figures 3-1 and 3-2 demonstrate the trend toward reduced coverage area with increased operating frequency. This trend continues into the 451-467 MHz range. Based on analysis at a limited number of sites in the VEC service area, it is our judgement that twice as many transmitter sites would be required for 400 MHz operation as are required for 150 MHz operation. Thus, 10 to 12 sites would be required. We believe that the increased number of sites would lead to an unacceptably high system cost even though acceptable performance is possible.

In light of the above observation, it is recommended that:

- the VHF radio be operated in the 30-50 MHz range,

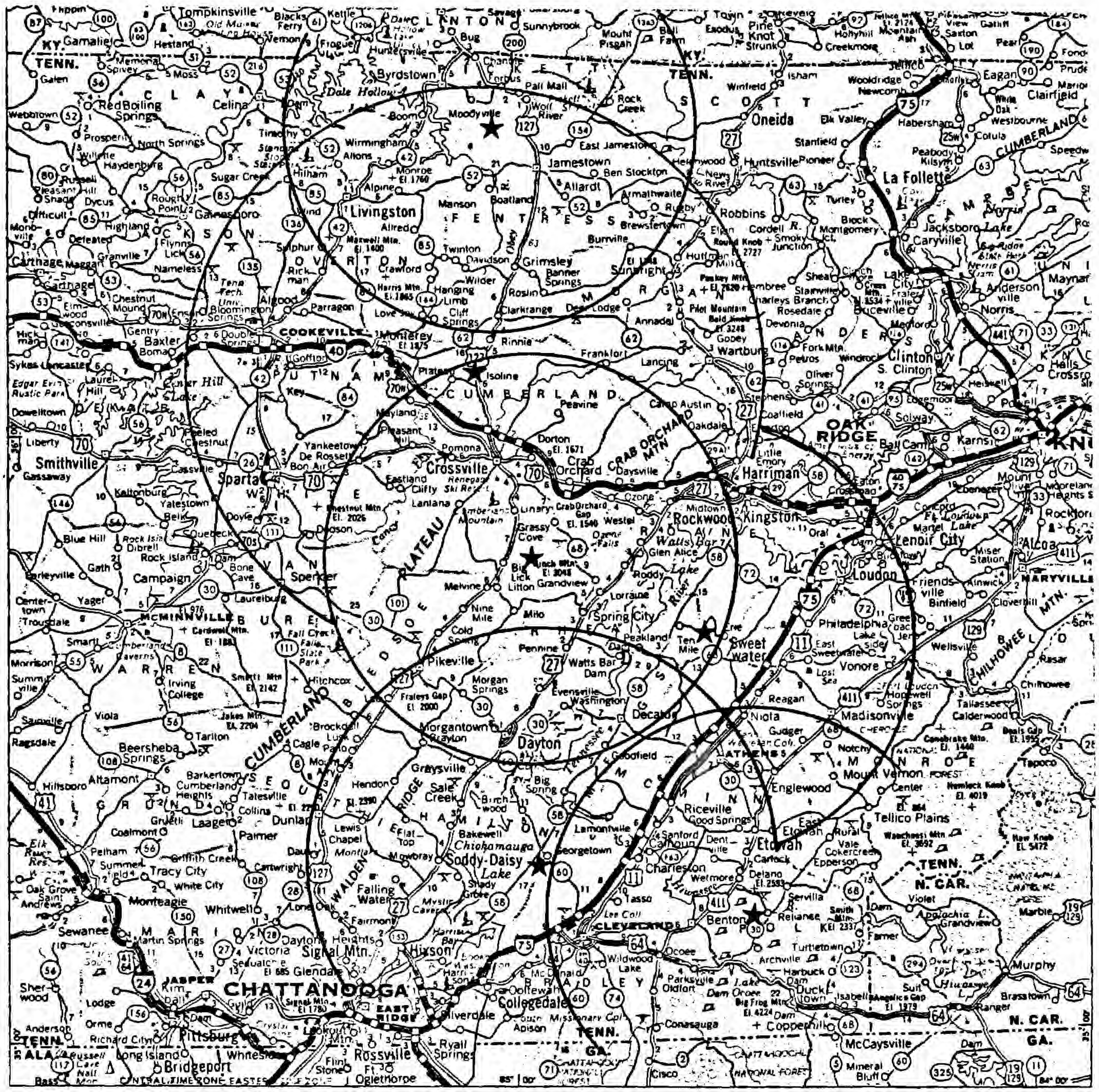


Figure 3-1. Generalized radio coverage at 38 MHz for 100 watt mobile unit.

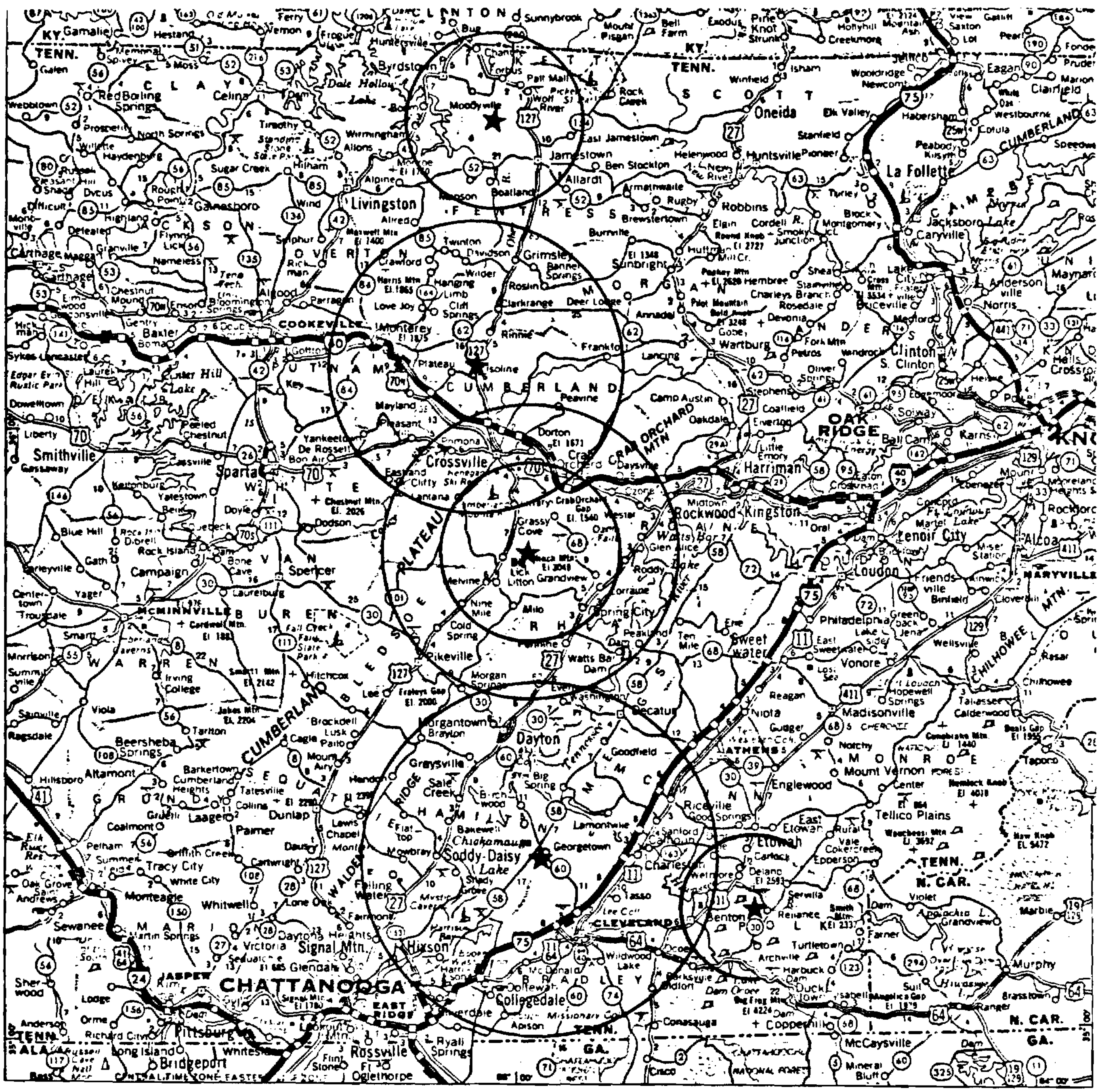


Figure 3-2. Generalized radio coverage at 160 MHz for 100 Watt mobile unit.

- the remote sites be set up as repeaters rather than remote base stations,

- the tower at each site should be approximately 200 ft. tall with an antenna mounted for omnidirectional coverage at the top (the possible exception to this is the Oswald Dome site near Benton where a cardioid pattern with its maximum pointed northwest may offer a slight advantage), and

- the transmitter employed at each site should be a high power unit if possible, typically 100-300 watts output.

A cost estimate for each of the radio equipment items is provided in Table 3-1. Tone squelch is both convenient and required for repeaters operating below 50 MHz. The touch tone key pads indicated provide service personnel a means of initiating with the mobile and hand-held units a connection with the control dispatching facility in Decatur.

TABLE 3-1

COST ESTIMATE FOR 25-50 MHz RADIO EQUIPMENT

ITEM	FEATURES	COST
BASE/ REPEATER UNIT	100 WATT TRANSMITTER, 0.5 MICROVOLT SENSITIVITY RECEIVER, WITH ONE SQUELCH	$4,300
	AUTOPATCH	$1,200
	0 dBi GAIN ANTENNA	$ 200
	WEATHERPROOF CABINET	$ 650
	TRANSMISSION LINE (<0.6 dB/100 FT ATTEN. AT 50 MHz)	$ 300
	CONNECTORS	$ 30
	TOTAL	$6,680
MOBILE UNIT	100 WATT TRANSMITTER, 0.5 MICROVOLT SENSITIVITY RECEIVER, 4 CHANNEL CAPACITY (2 INSTALLED) TOUCH-TONE CONTROL UNIT ANTENNA	$2,300
HAND-HELD UNIT	6 WATT TRANSMITTER, 0.5 MICROVOLT SENSITIVITY RECEIVER, 4 CHANNEL CAPACITY (2 INSTALLED), ANTENNA, CHARGER, TOUCH-TONE PAD	$1,800

APPENDIX A

RADIO COVERAGE PATTERN

Figures 3-1 and 3-2 provided simplified coverage patterns for radio transmitters in the VEC service area. The material in this appendix is basically the detailed patterns using 15^{o} radials for 38 MHz and 160 MHz operation. In some instances, a pattern for 38 MHz operation will not appear for a given site. In general, this means that the predicted coverage extended 50 or more kilometers in all directions. Presenting such a plot would convey little useful information, and given the nature of the terrain involved, there is some question about the validity of coverage projections beyond the 50 kilometer range.

Some coverage analysis was also done for 450 MHz operation; however, none of those results are presented here. In general, the 450 MHz coverage patterns were similar in shape to those at 150 MHz, but the range was dramatically reduced. This led to the conclusion that 450 MHz operation was possible but would require possibly twice as many fixed sites as are required for either 38 MHz or 150 MHz.

It should be pointed out that the analysis leading to the results presented in Figures A-1 through A-11 used general frequencies in the ranges of interest rather than specific frequencies targeted for actual use. This approach is valid since the coverage characteristics at 39 MHz are not significantly different from the characteristics at 38 MHz.

Finally, it is important to understand the assumptions made in analyzing the radio coverage. For the 38 MHz case, the following values were asseumed:

Transmitter output: 100 watts

Transmitter antenna gain: 0 dBi

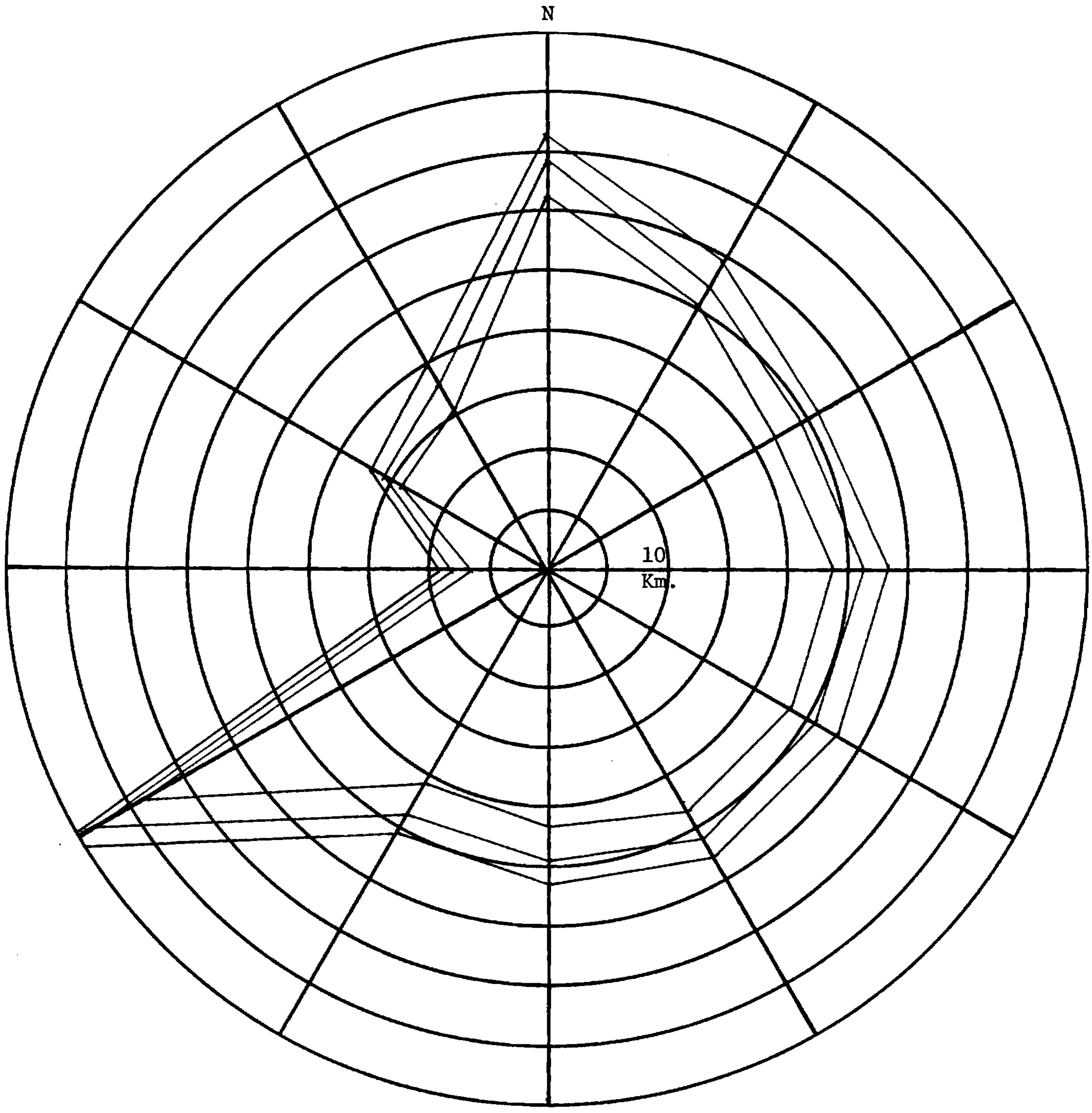


Figure A-1. 160 MHz coverage for Walden Ridge site.

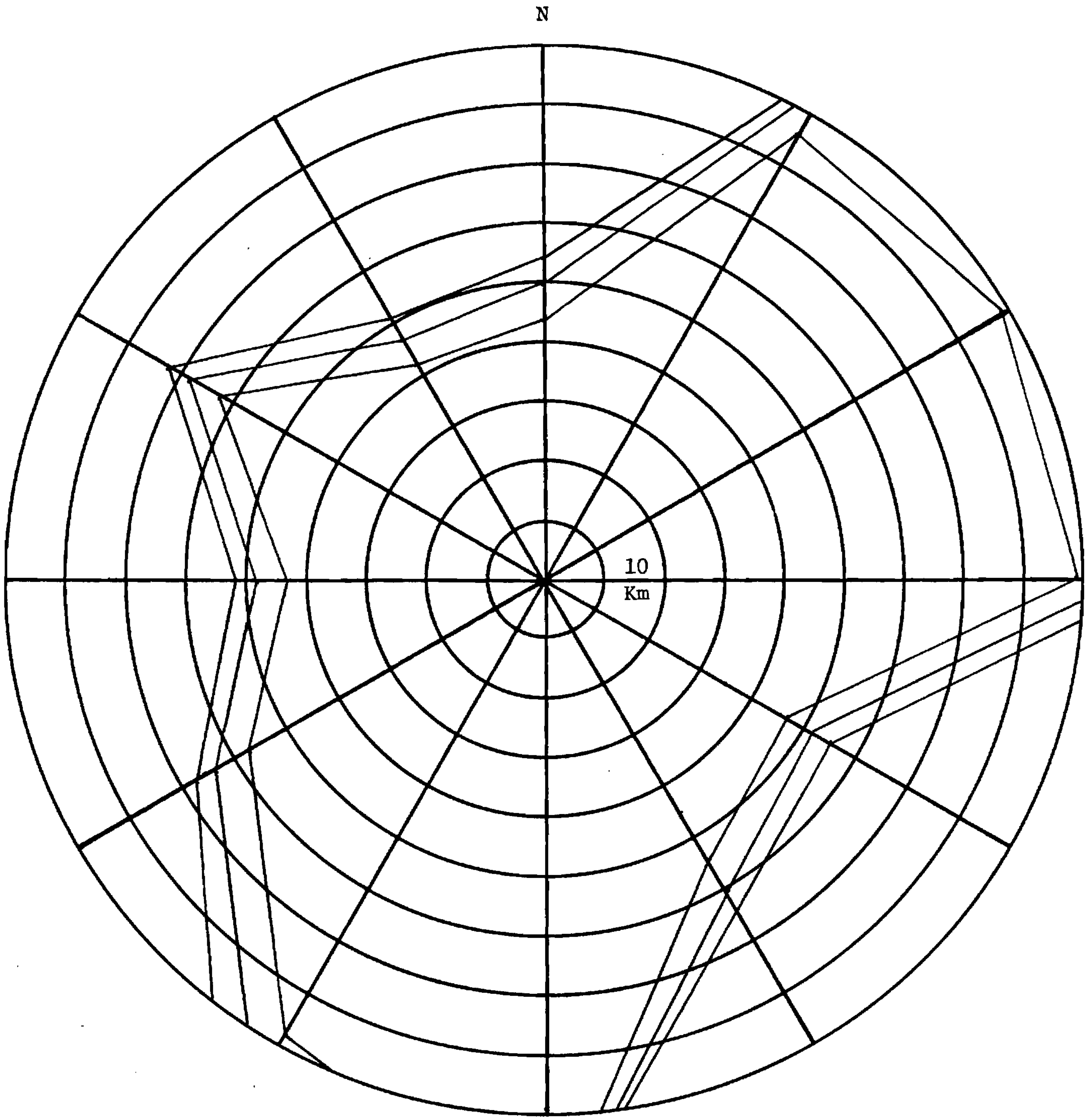


Figure A-2. 160 MHz coverage for Isoline site.

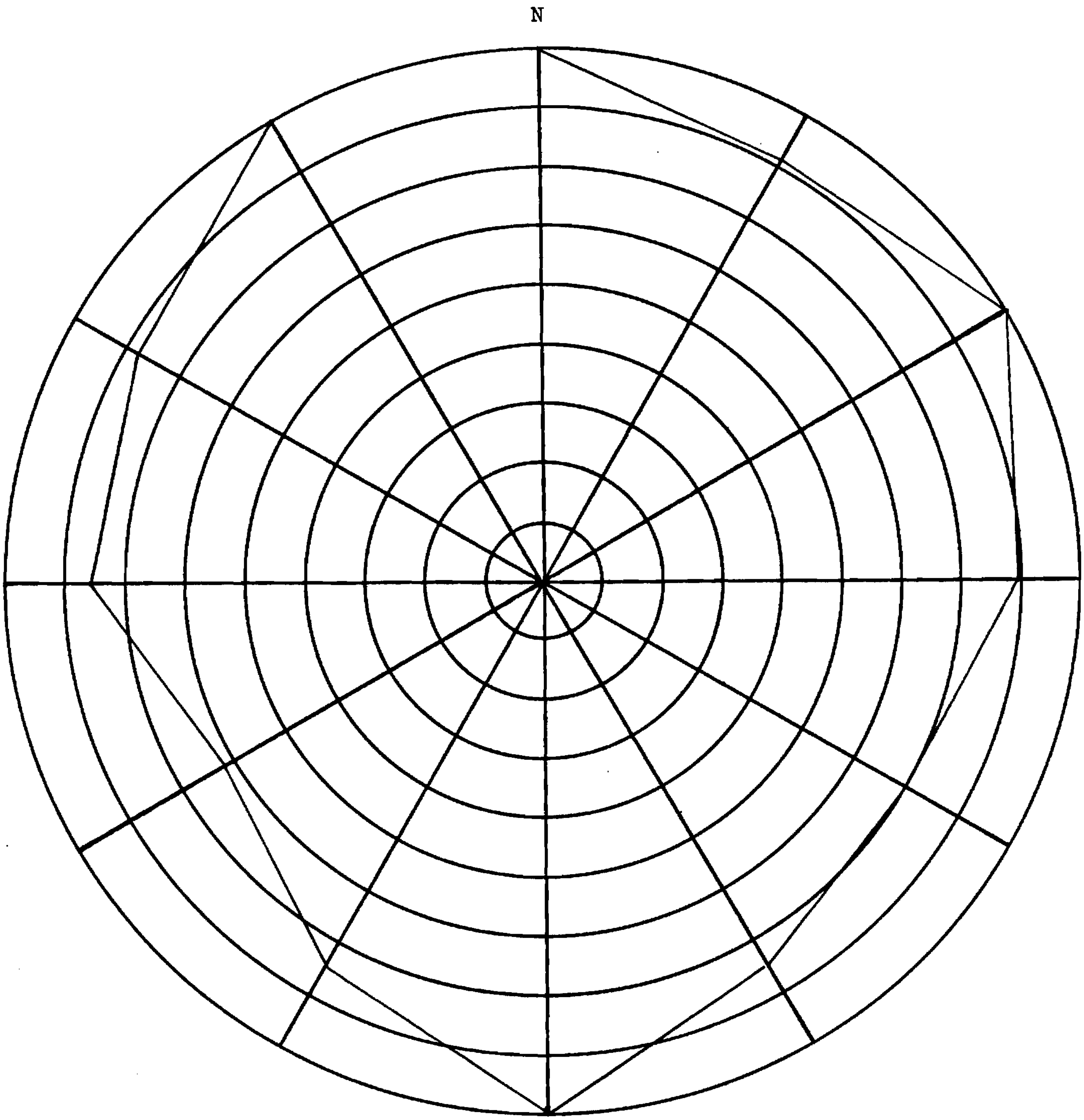


Figure A-3. 38 MHz coverage for Hinch Mtn. site.

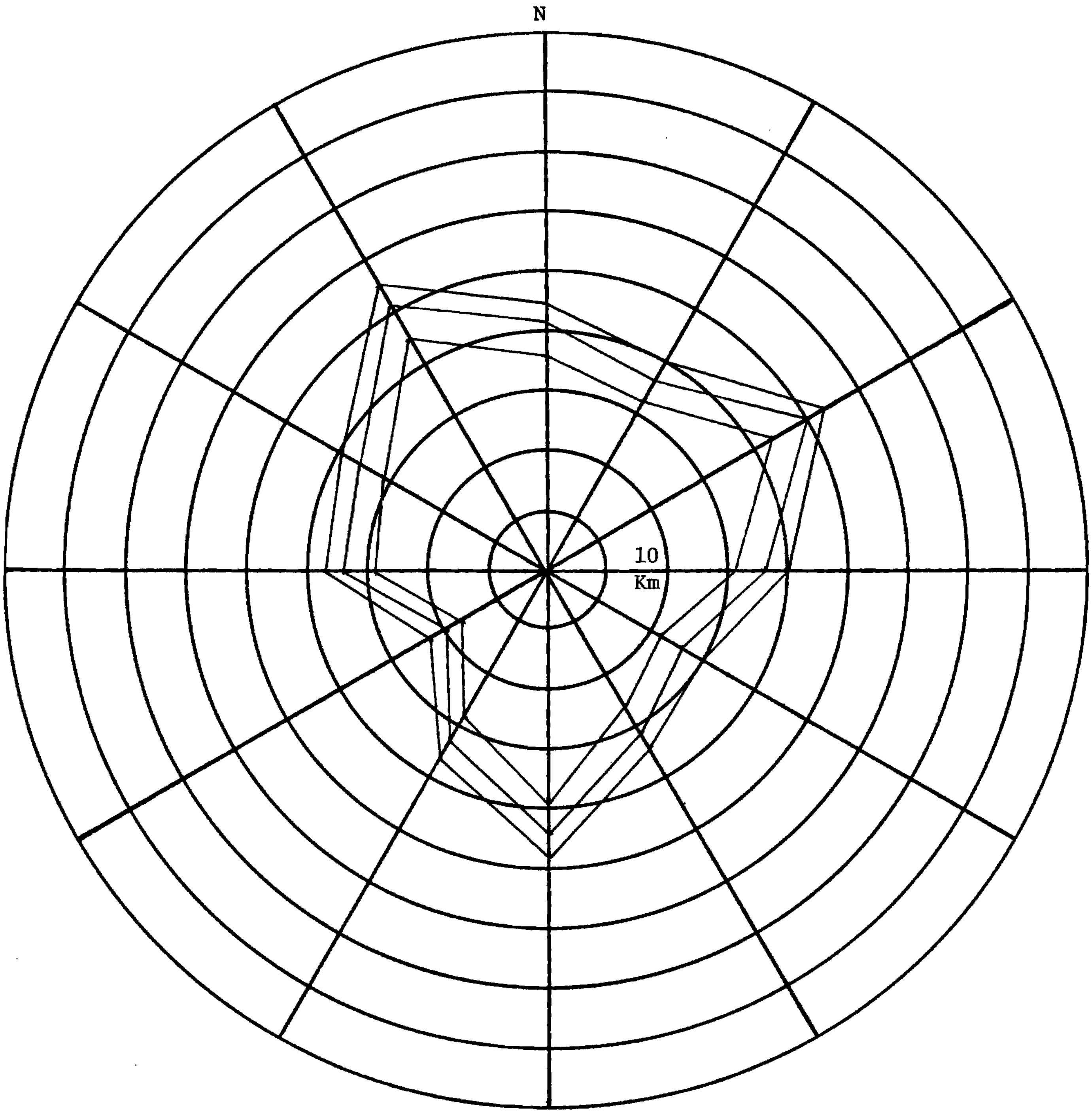


Figure A-4. 160 MHz coverage for Hinch Mtn. site.

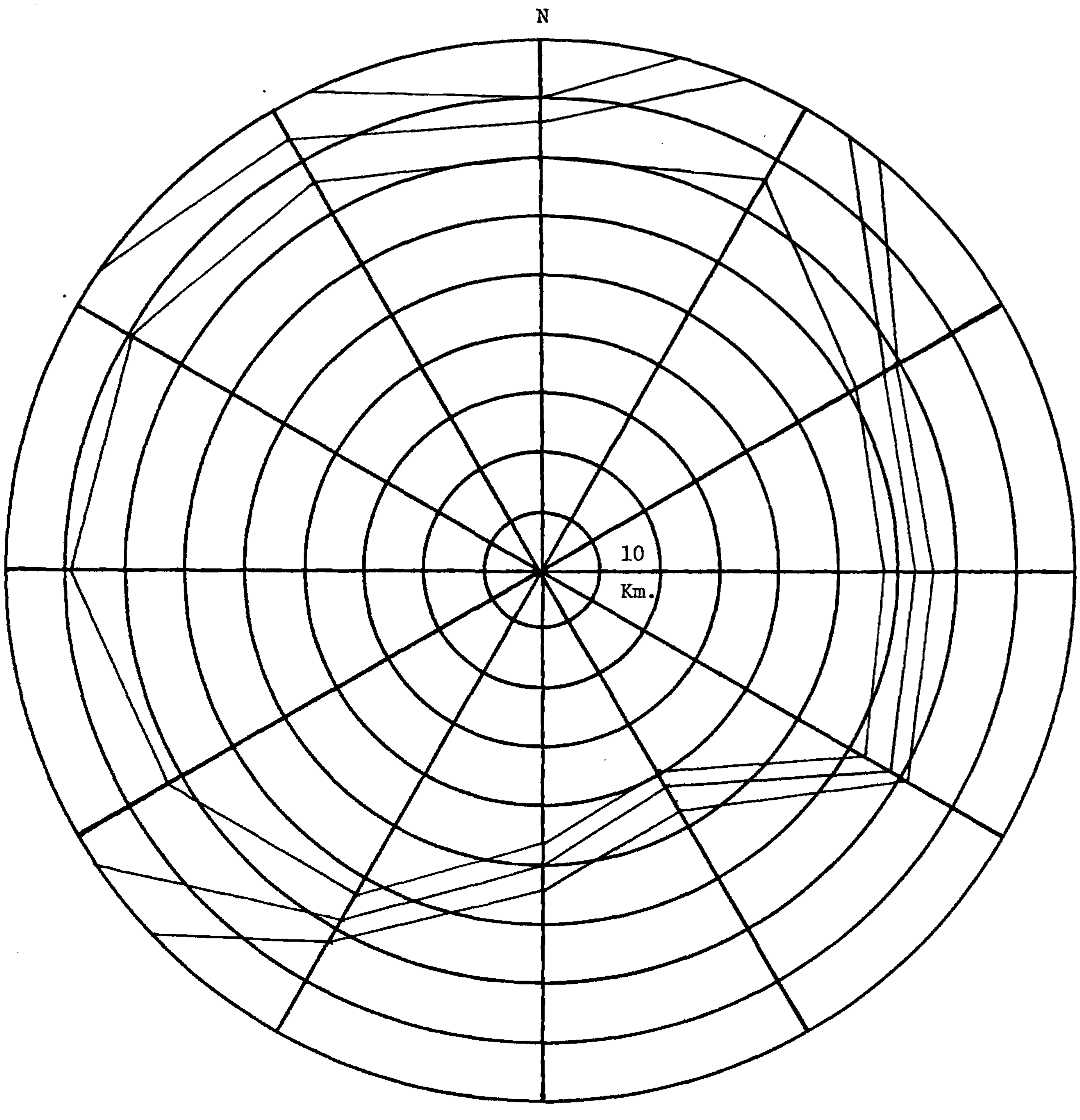


Figure A-5. 38 MHz coverage for Chilhowee Mtn. site.

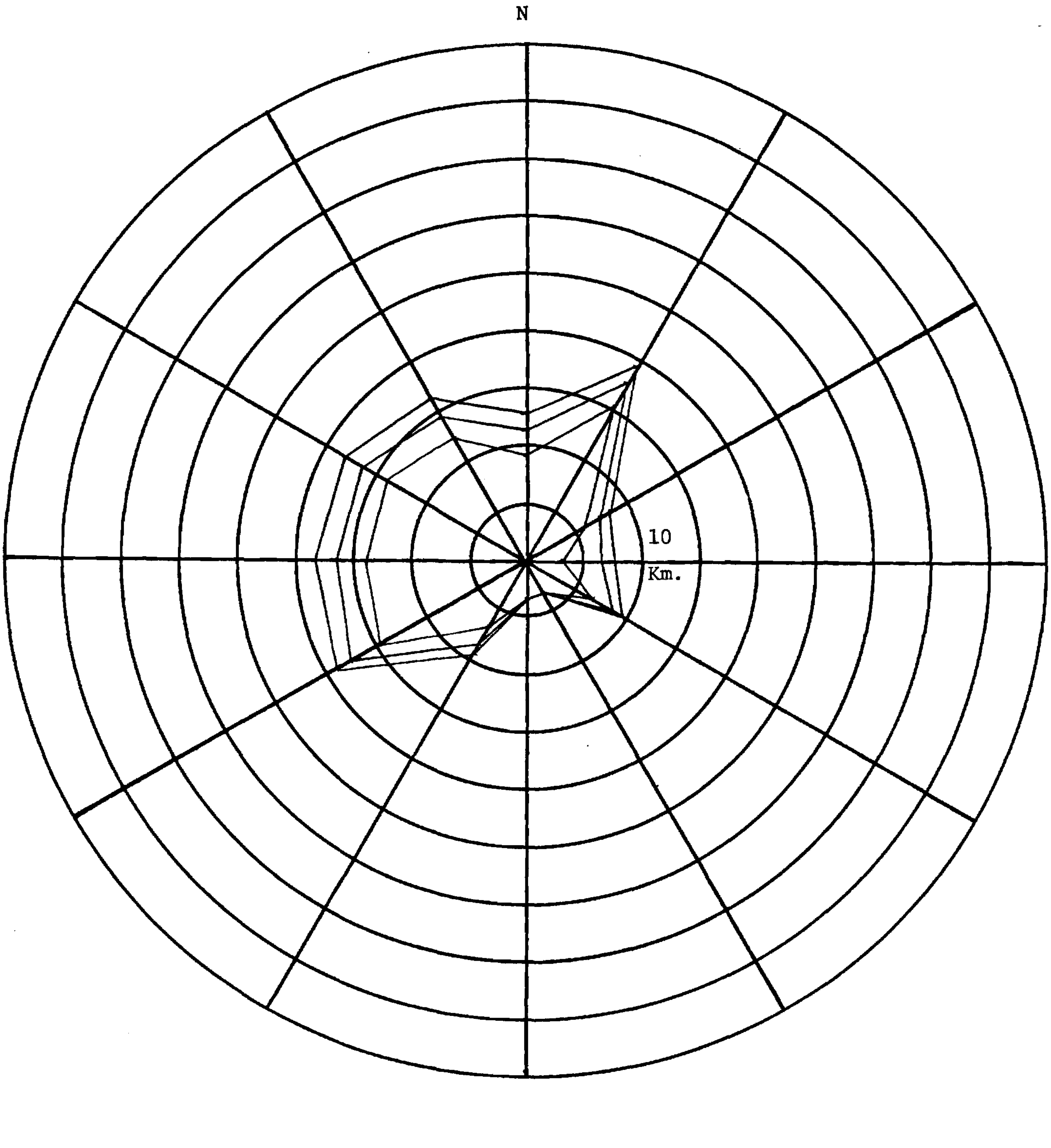


Figure A-6. 160 MHz coverage for Chilhowee Mtn. site.

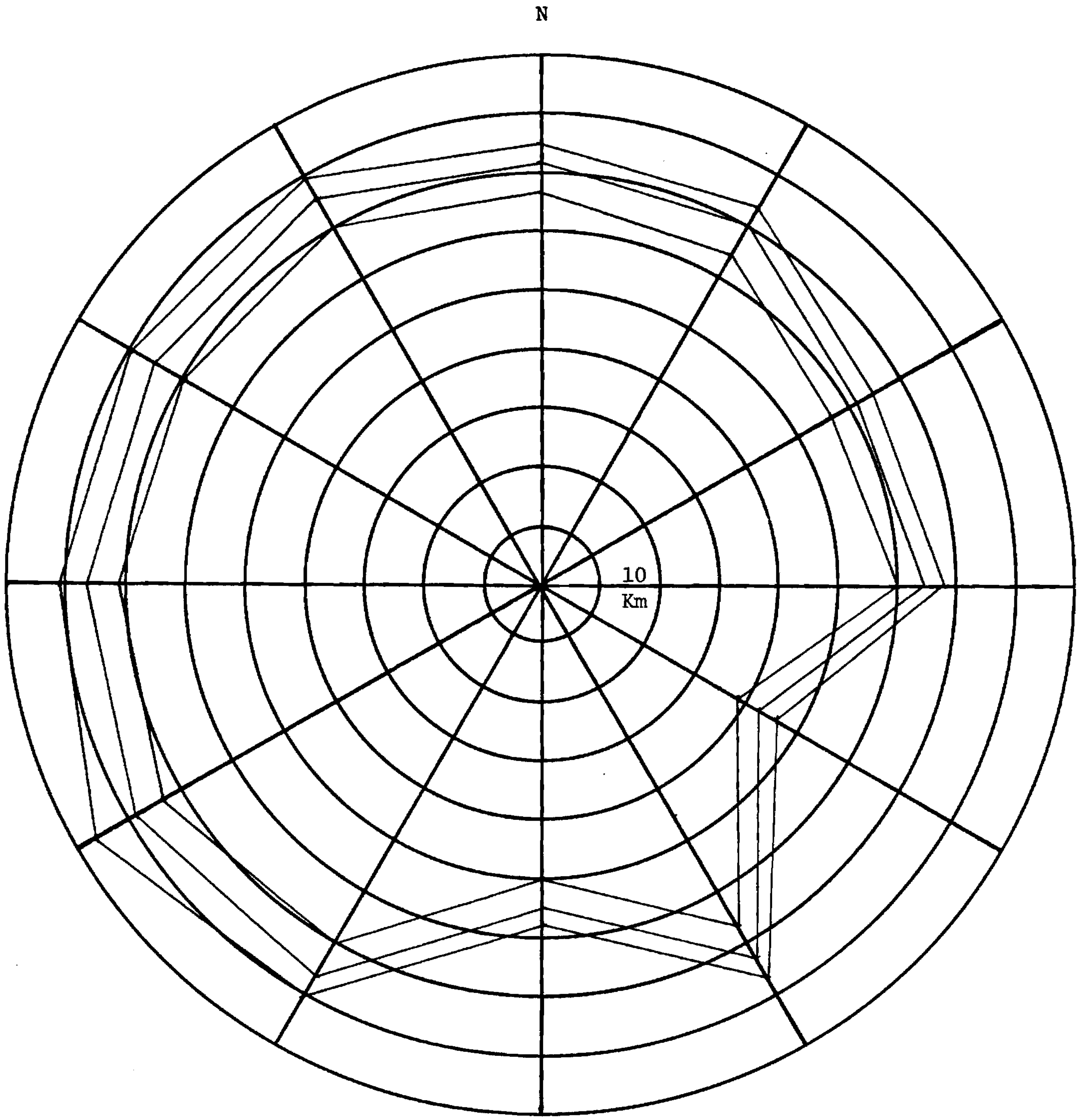


Figure 4-7. 38 MHz coverage for Oswald Dome site.

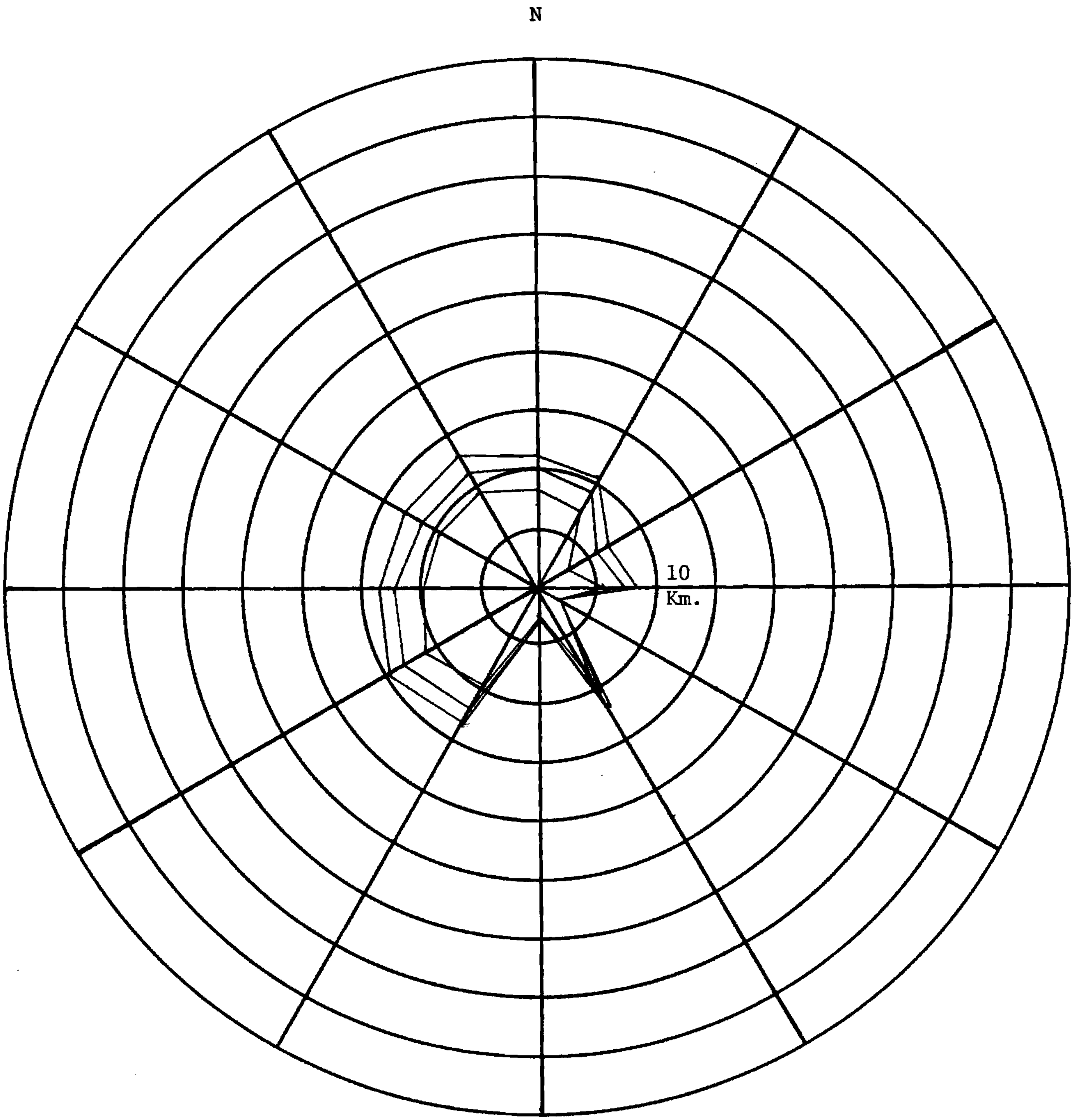


Figure A-8. 160 MHz coverage for Oswald Dome site.

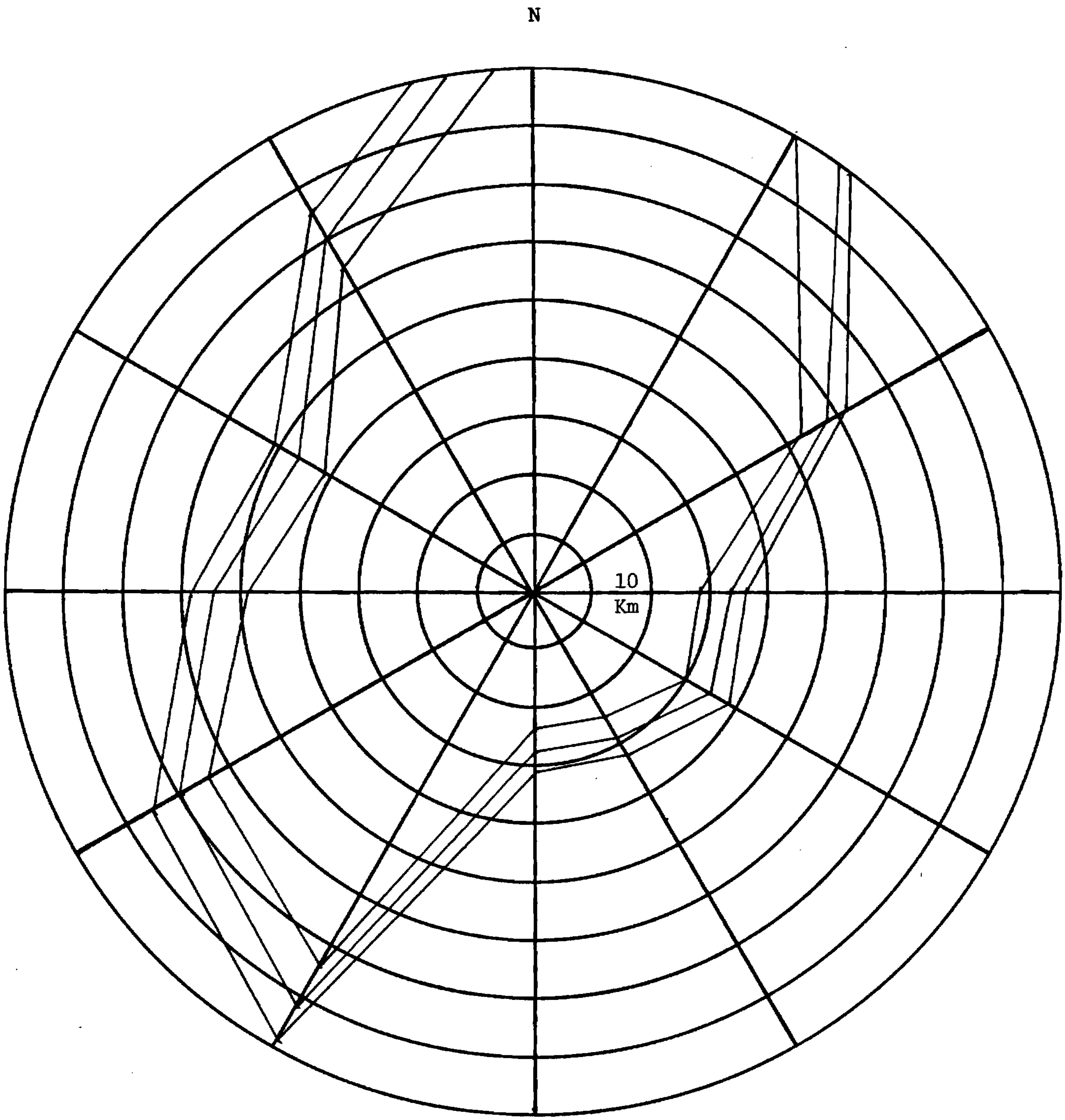


Figure A-9. 160 MHz coverage for Crossville site.

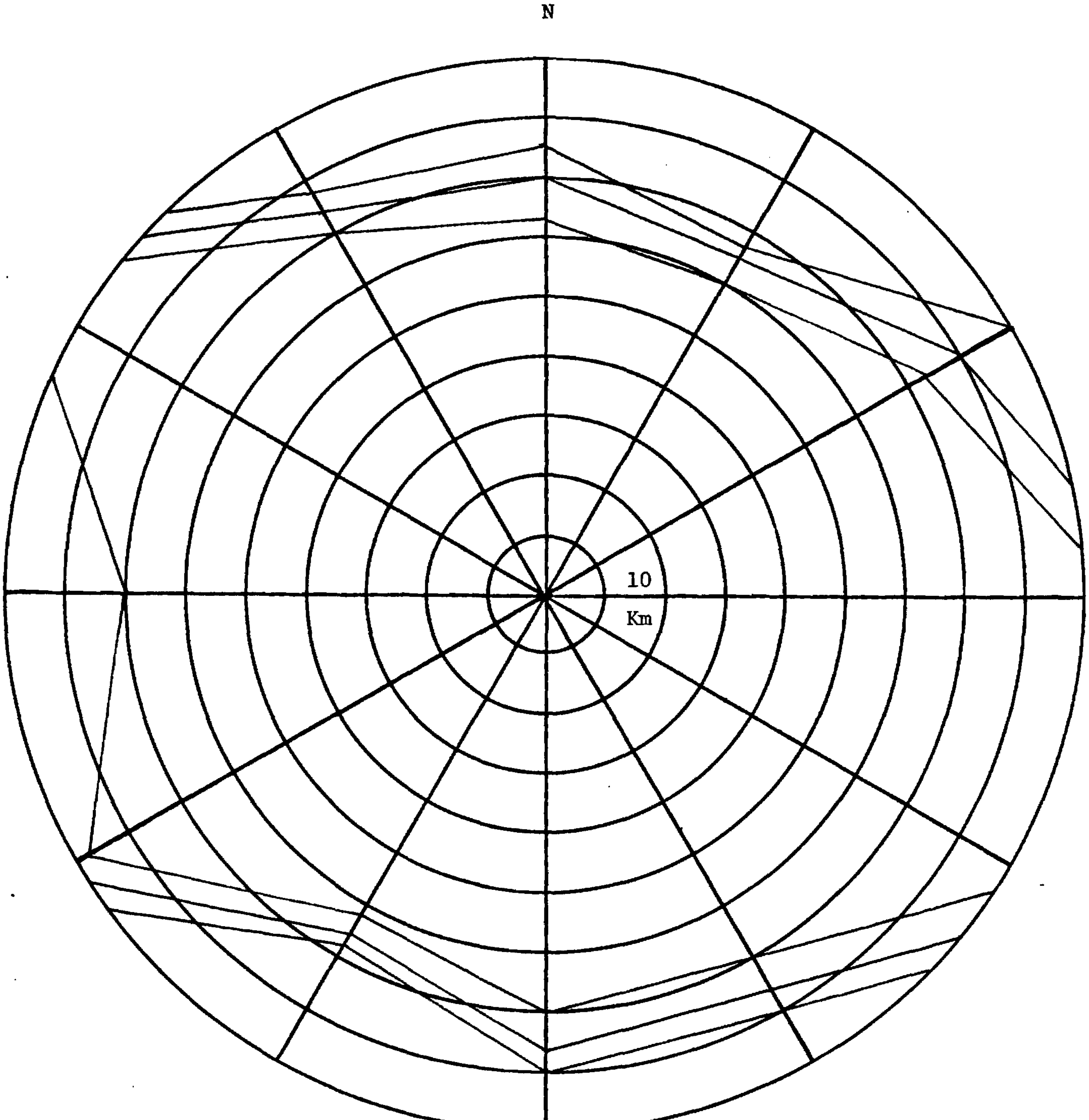


Figure A-10. 38 MHz coverage for Jamestown Repeater site.

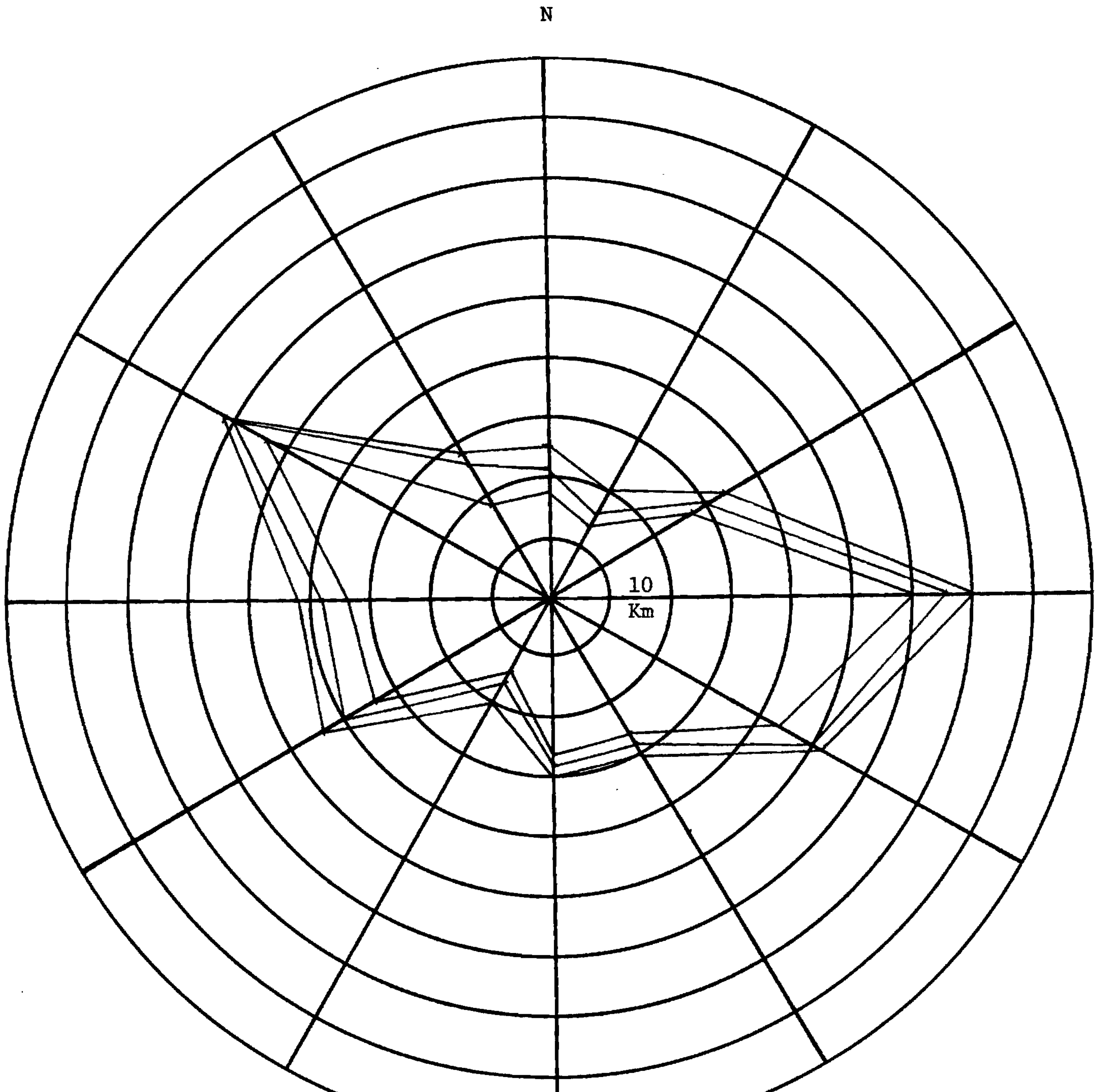


Figure A-11. 160 MHz coverage for Jamestown Repeater site.

Receiver antenna gain: 0 dBi

Receiver sensitivity: 0.5 microvolts
(20 dB quieting)

For the 160 MHz case, the following values were used:

Transitter output: 100 watts

Transmitter antenna gain: 5 dBi

Receiver antenna gain: 0 dBi

Receiver sensitivity: 0.5 microvolts
(20 dB quieting)

APPENDIX B

TOWER SITES

This appendix contains detailed maps indicating the exact location of the towers used in planning the microwave system and in doing coverage analysis for the VHF radio. The sites of interest are defined in Figures B-1 through B-7. Site coordinate information is summarized in Table B-1.

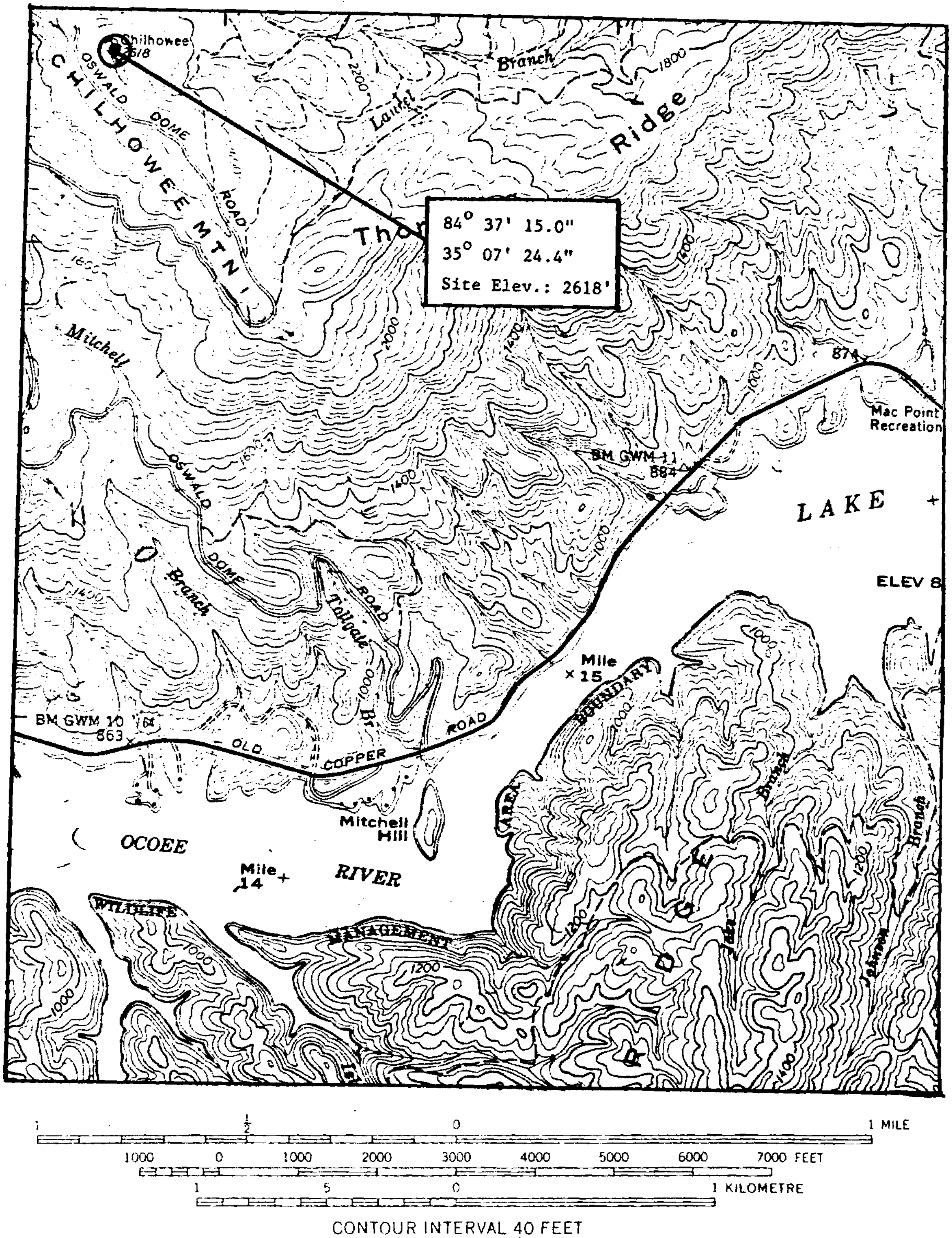
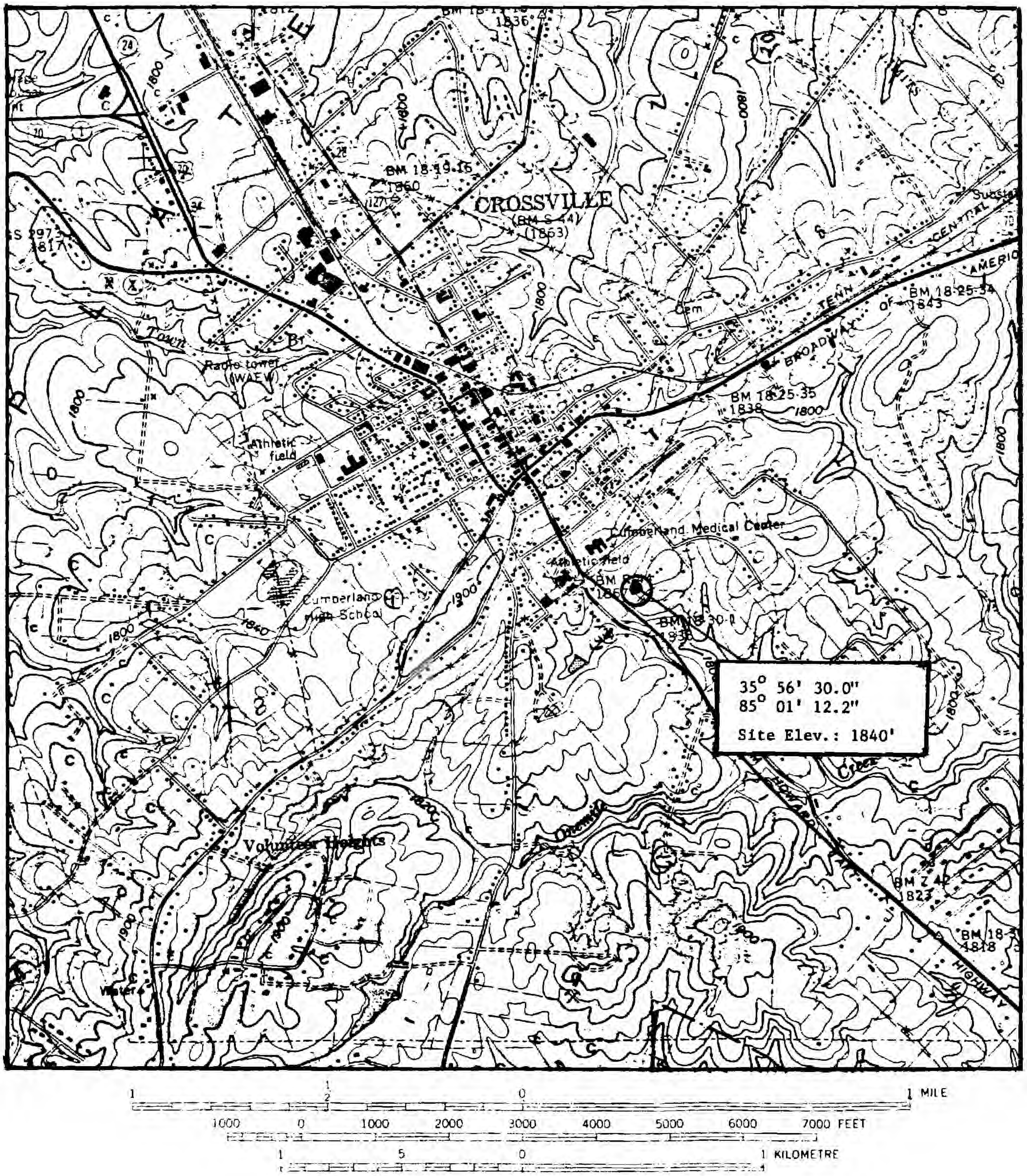


Figure B-1. Chilhowee Mountain Tower Site.



CONTOUR INTERVAL 20 FEET

Figure B-2. Crossville Tower Site.

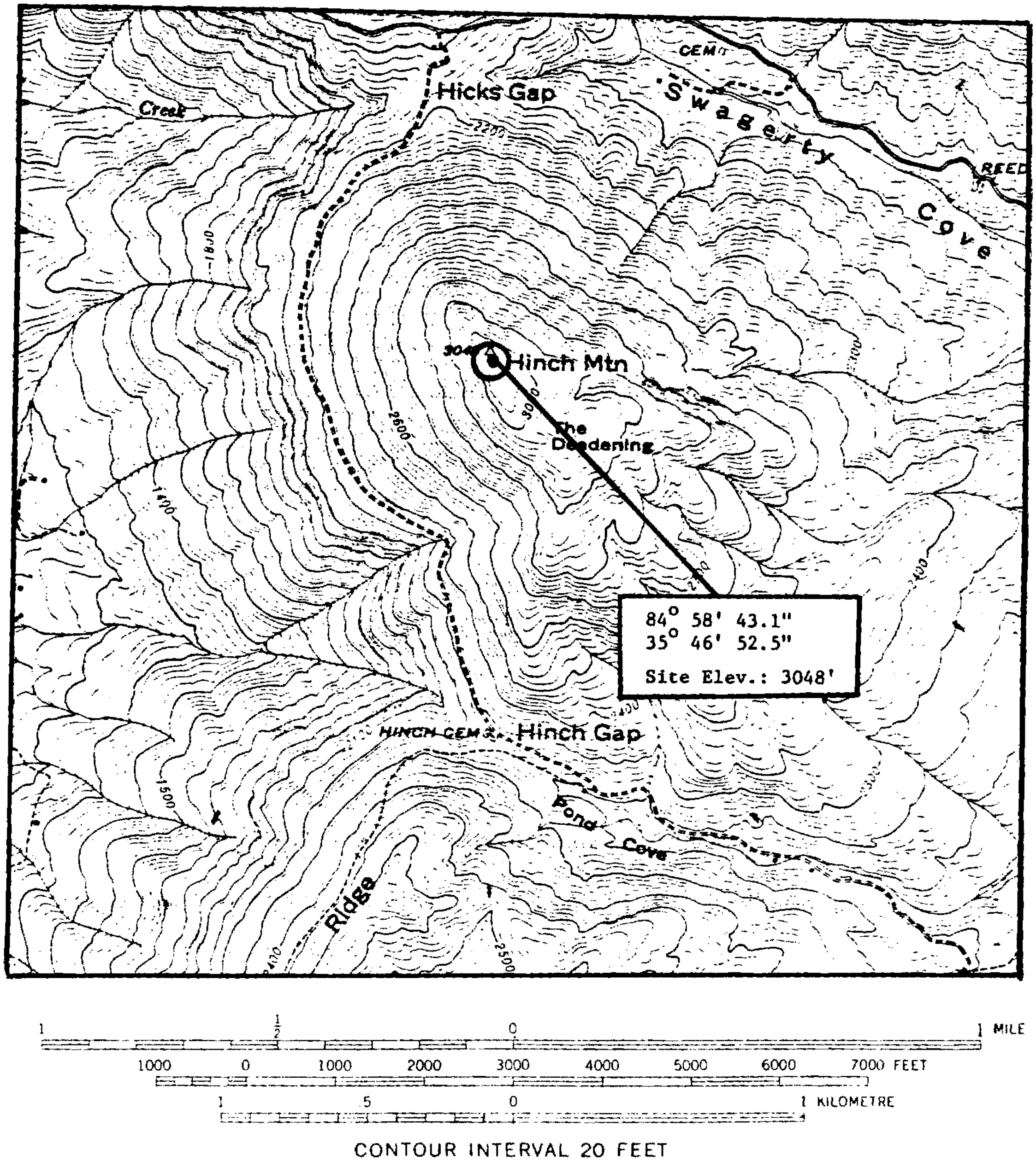


Figure B-3. Hinch Mountain Tower Site.

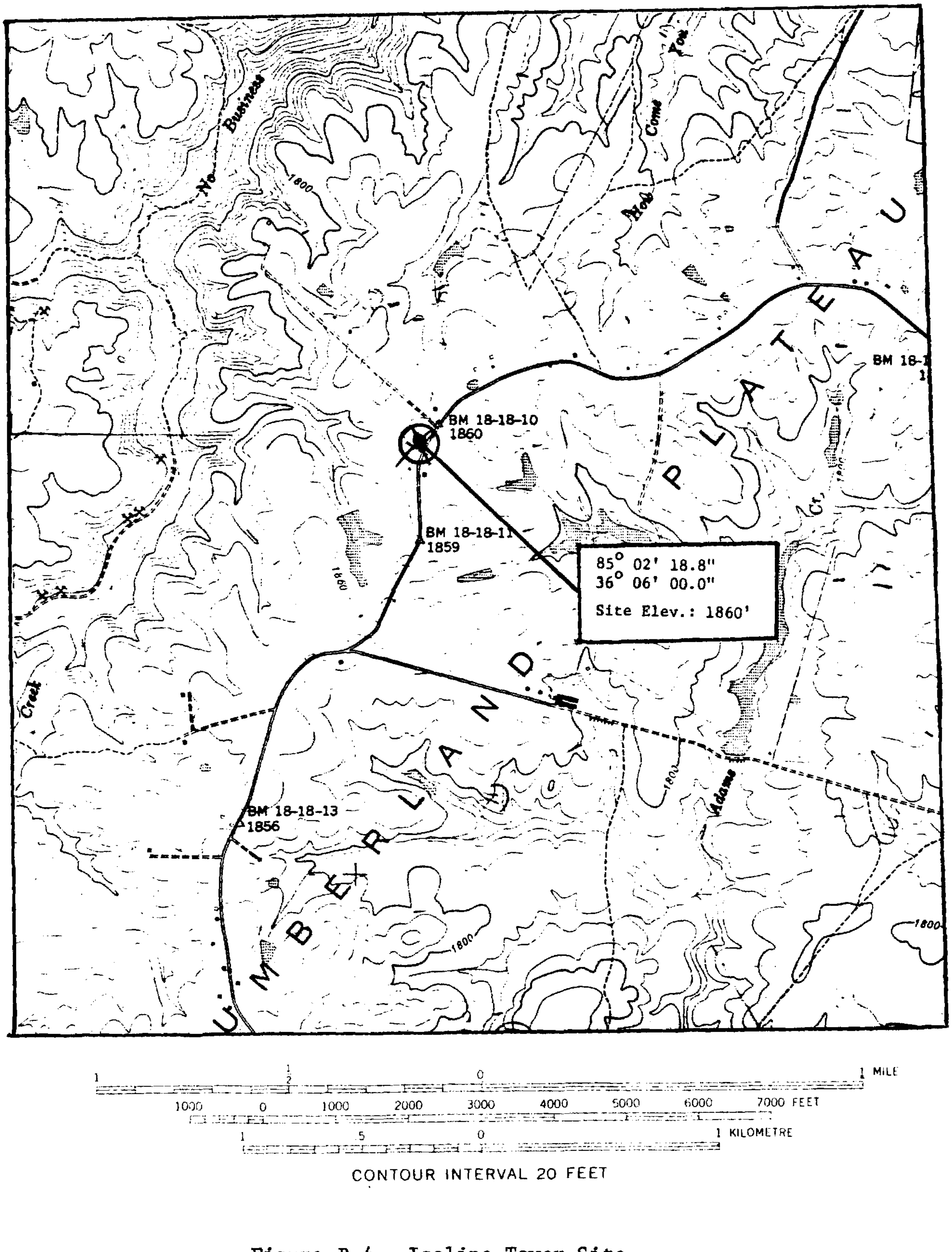


Figure B-4. Isoline Tower Site.

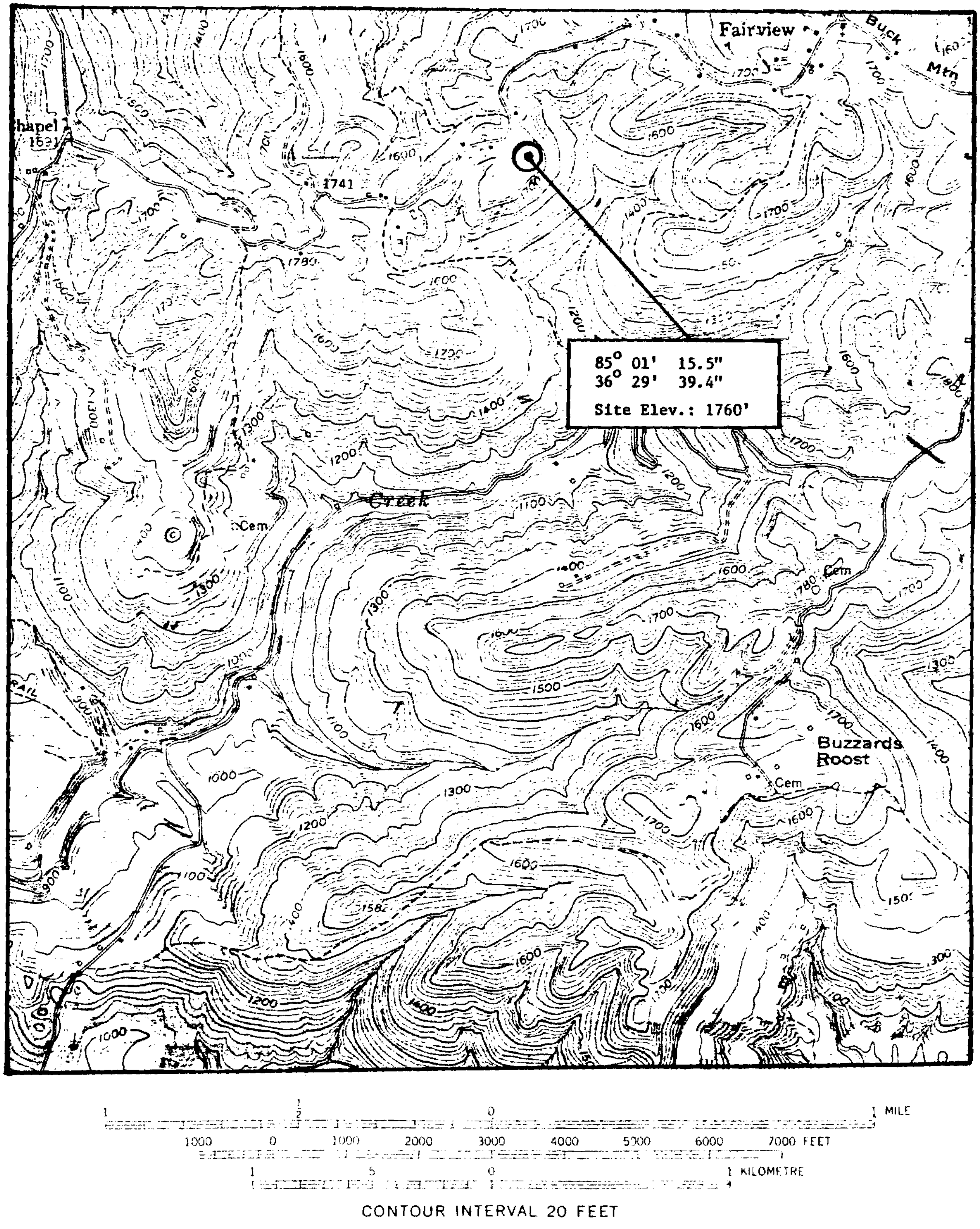


Figure B-5. Jamestown Repeater Site.

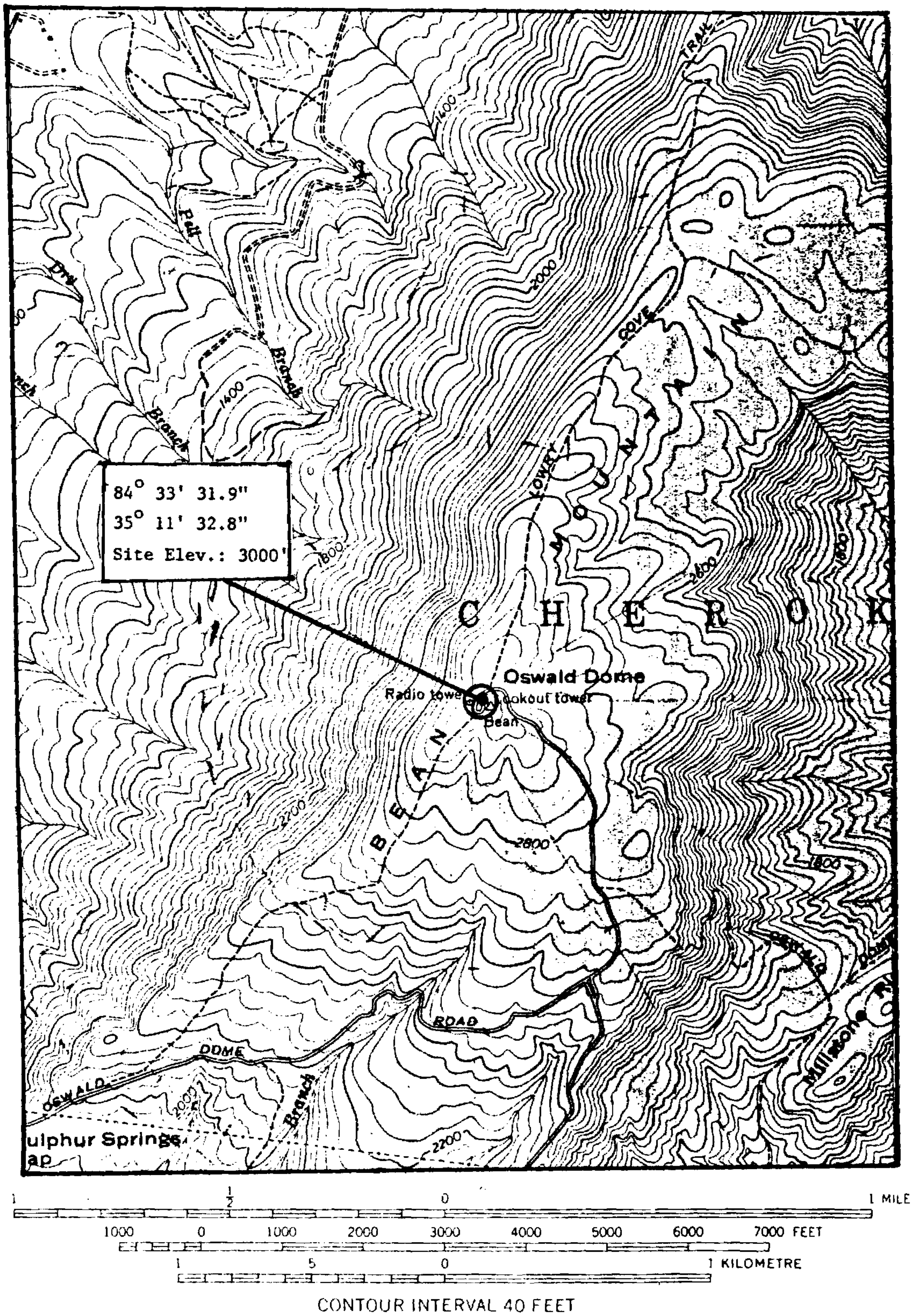


Figure B-6. Oswald Dome Tower Site.

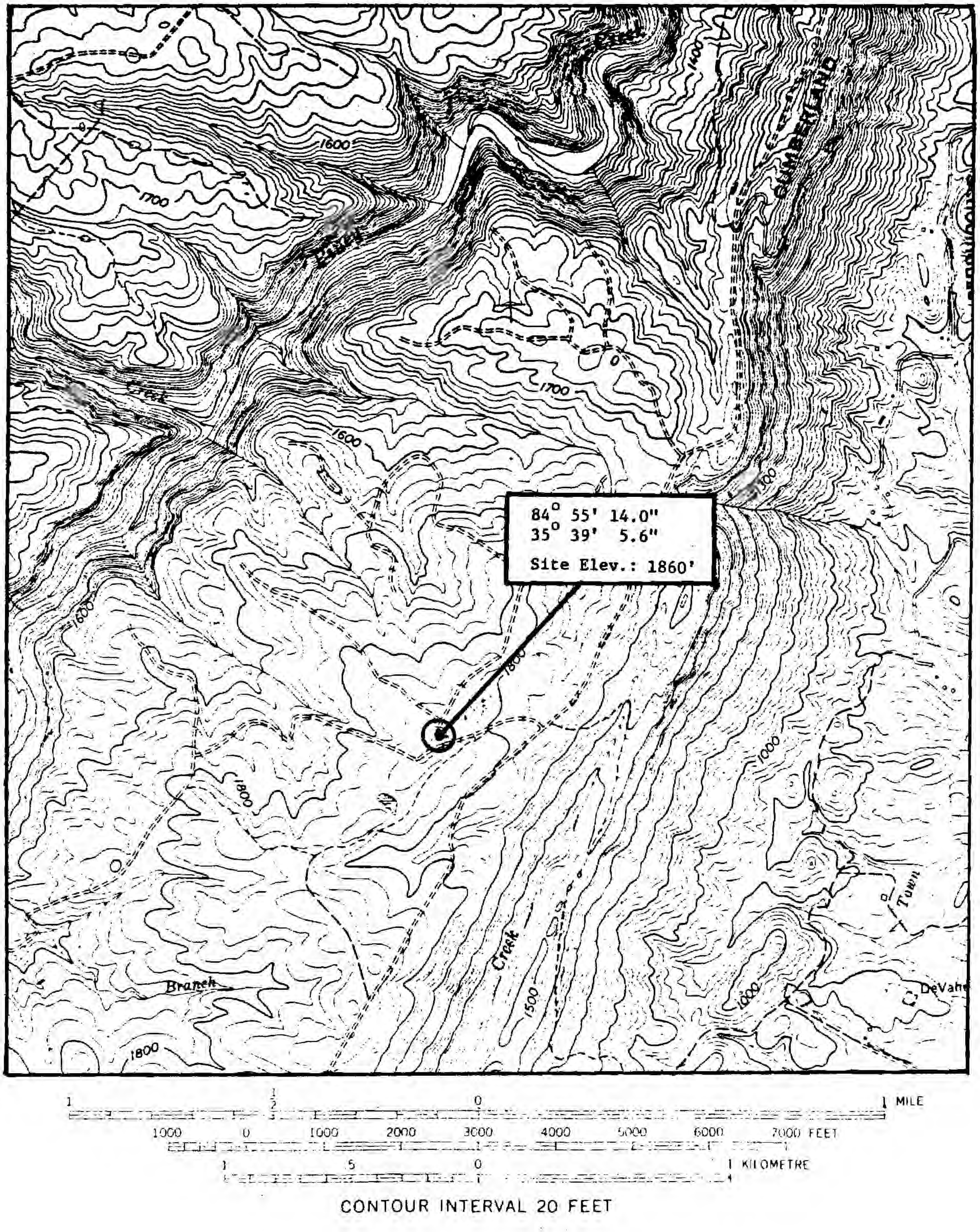


Figure B-7. Walden Ridge Tower Site.

TABLE B-1

SUMMARY OF SITE COORDINATES

SITE	LATITUDE (°N)	LONGITUDE (°W)
BENTON OFFICE	35° 10' 4.68"	84° 39' 26.13"
BYRDSTOWN OFFICE	36° 34' 13.25"	85° 07' 49.35"
CLEVELAND OFFICE	35° 12' 53.77"	84' 49" 49.35"
REPEATER	35° 13' 49.87"	84' 51" 47.42"
CROSSVILLE OFFICE	35° 65' 30.0"	85° 01' 12.2"
DEATUR OFFICE	35° 31' 5.45"	84° 47' 23.23"
REAPEATER	35° 32' 3.12"	84° 47' 59.03"
GEORGETOWN REPEATER	35° 15' 42.86"	84° 57' 57.10"
HINCH MTN. REPEATER	35° 46' 52.5"	84° 58' 43.1"
ISOLINE REAPEATER	36° 06' 0.0"	85° 02' 18.8"
JAMESTOWN OFFICE	36° 25' 42.47"	84° 55' 49.35"
REPEATER	36° 29' 39.40"	85° 01' 15.5"
MONTEREY OFFICE	36° 08' 33.51"	85° 16' 14.52"
REPEATER	36° 08' 25.71"	85° 15' 06.77"
OSWALD DOME REPEATER	35° 11' 32.80"	84° 33' 31.90"
SPRING CITY OFFICE	35° 41' 16.36"	84° 51' 47.42"
TEN MILE REPEATER	35° 39' 00"	84° 37' 30"

APPENDIX C

EXISTING TOWERS

In the course of this design effort, we encountered a variety of existing towers which potentially could be used for either microwave or VHF radio sites. In our judgement, none of these towers fit into a logical microwave or VHF radio network for VEC; however, we have included a description of the towers encountered in our design effort. The pertinent data appears in Table C-1 and it is emphasized that the information in the table is not presented as being inclusive of all towers in VEC's service area.

TABLE C-1

EXISITNG COMMERCIAL TOWERS

OWNER	CONTACT	TOWER COORDINATES	TOWER HEIGHT	TOWER LOAD INFORMATION	EXISTING LOAD TYPE	EXISTING LOAD FREQUENCY	EXISTING LOAD LOCATION	LEASING CHARGE	OTHER
Cleveland									
WBAC P.O. Box 3180 Cleveland, TN 37311	Wm. Thomason (615) 476-7593	35-09-54 84-51-19	320'	30/35 PSF (more structural information available from Stainless Inc.	UHF Satellite receiver	450.05MHz	135' from bottom 75' away from tower	(negotiable)	Tower must be retuned in accordance with FCC Rules and Regs (estimate: ~$500)
WQNE P.O. Box 1053 Cleveland, TN 37311	David Robinson (615) 476-2221	35-13-48 84-51-45	187'		FM	98.3 MHz	top of tower	~ $100/mo	Two TV stations have petitioned to lease space (locations unspecified).
TVA 409 Chattanooga Building Chattanooga, TN 37901	D. R. Jernigan (615) 472-3355	35-11-05 84-49-16	250'	40 PSF (flat); 26.7 PSF (cylindrical); 1.5 x projected area (tower designed for microwave operation)	(Crowded some room bottom).	but there about 18	might be 0' from	(negotiable)	(Need to petition TVA for space; a long lead time might be involved.)
Crossville									
WAEW P.O. Drawer W. Crossville, TN 38555	Warren Dean (615) 484-5115	35-56-59 85-02-08	203'		FM	99.3 MHz	8' from top	$75-$125/mo per dish + retuning costs	Space is available ~195' and below; retuning charge: ~$ 1,000
WCPT-TV P.O. Box 608 Crossville, TN 38555	John Cunningham (615) 484-8424	35-53-08 84-51-34	148'	45G Rohn (tower can hold micro λ; has held two 4' dishes)	(None as 1981)	of the sum	mer,	$75-$100 per no. per dish	Space is available anywhere on tower as of summer, 1981.
Monterey									
C&S Communications 114 N. Cedar St Cookeville, TN 38501	Charles Cobble (615) 528-5502	36-05-04 85-22-40 (Location is midway between Monterey and Cookeville on mountain ground elevation: 1850')	150'	Rohn SP-SSV series (built for micro λ)	(tower is and space able to 1981)	being con should b lease in s	structured e available ummer,	$75-$100, per no. per dish	Space is available anywhere on tower, including top. Also, a building will be available.

TABLE C-1 (Continued)

OWNER	CONTACT	TOWER COORDINATES	TOWER HEIGHT	TOWER LOAD INFORMATION	EXISTING LOAD			LEASING CHARGE	OTHER
					TYPE	FREQUENCY	LOCATION		
<u>Oswald Dome</u> Independent Communications 325 Shakespeare Dr Redding, PA 19608	Charles Whitmire (215) 678-8634	35-11-33 84-33-32	200' (on Dome at 3011')	(tower is being erected to hold micro λ)	(tower is being constructed and space should be available to lease in August, 1981)			(negotiable)	

APPENDIX D

A consideration in selecting an appropriate site for a tower is the availability of power for the radio equipment. The best site in terms of providing optimum coverage may not be near a readily accessible ac power supply. The terrain up the side of the mountain to site location may be rugged and the roads, secondary, if at all. Consequently, the cost of running ac powerline into the site may prove quite costly.

There are several such proposed sites described in this report. The location on Hinch Mountain and the sites for the repeaters were chosen to provide the best dual coverage for the VHF and microwave applications. However, in all cases, terrain characteristics of the sites are rugged, especially in the case of Hinch Mountain. Roads also appear to be secondary at best into both locations.

However, rather than change the location from a prime site in terms of coverage to a less satisfactory one in order to provide access to ac powerlines, an alternative worth considering is to use an independent power source. One approach is to use a photovoltaic power source with a battery bank. Photovoltaic (PV) cells have been used in a number of communications-related applications successfully over the past decade. WBNO, an AM broadcast station, uses PV panels with batteries to power its 500 watt, daytime-only operation. More typically, PV systems have been used to provide independent power for repeaters and radio equipment with low primary power requirements. Systems perform reliably in climates as varied as that typical of the southwest as well as in Alaska where PV power systems operate successfully despite snow cover. The Bureau of Land Management with the Department of the Interior, for example, has used PV arrays to sustain a two-way radio network along the US-Canadian border for over 10 years. In another example, General Electric maintains a UHF solid state radio repeater on Mt. Cardigan in New Hampshire with a PV power system; the repeater provides direct line-of-site transmission for over 800 square miles.

Vendors have begun to offer product lines with economized power requirements which require dc input. Flash Technology Corporation, for instance, offers FAA-approved obstruction lighting for towers requiring a dc power source. The beacons were designed especially for use with wind-driven, photovoltaic or thermoelectric generators. Manufacturers of radio equipment also offer product lines requiring dc input with low primary power requirements, Motorola and GTE among them.

Typically, a vendor will size a system based on site location, climate, load requirements and overall environment. It has been estimated that a photovoltaic system of sufficient capacity to power the Hinch Mountain site would cost approximately $29,000. This estimate is based upon the following load evaluation.

Microwave:
Duty cycle: 100%
24 V dc input
(3) 24-watt radios (use 75 W)

VHF:
Duty cycle: Transmit: 10%
Receive/Standby: 90%
24 V dc input
Radio in 100 W-150 W range

For convenience in sizing the system, Motorola's C73RTB3105 VHF radio (110 W) was used which requires 20.5A in the transmit mode and 2A in receive. The desired system should provide for 10 day battery reserve. Alternative Energy Engineering (AEE) in Redding, California, sized and priced such a system although there are number of companies, including Motorola and Solarex, which provide photovoltaic systems.

According to AEE, the required power can be supplied by two banks of 8 solar panels each for the 24V (microwave) system. Each panel consists of 33 wafers (PV cells), providing one watt each. The cells are connected in series to provide 33 watts per panel. Eight panels are then connected in parallel and the two banks of eight are connected in series to provide the required 24V source.

The 12 volt system for the VHF application will require two banks of 8 and 7 panels each. The panels are connected in parallel and the banks in series.

18 six volt deep discharge batteries, two voltage regulators and mounting structures with related wiring are included in a total package price of $23,300. The microwave support system has a separate estimate at $12,000, requiring 10 batteries, and the VHF, $11,300, requiring 8 batteries. A PV system to sustain tower lighting for a structure of 200' or more has been estimated at an additional $4,000.00.

Each panel requires 4 square feet of land area. The proposed system of 39 panels then requires a minimum of 156 square feet. AEE recommends purchasing the batteries from a local supplier as shipping lead batteries from California add to the cost considerably.

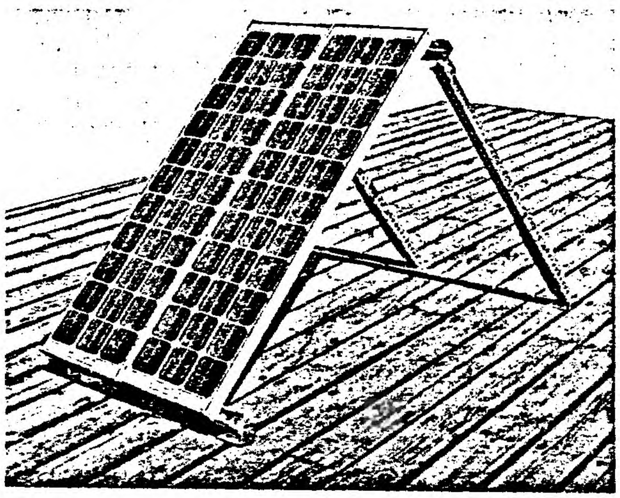
There are additional consideration. If an area is heavily wooded and trees cause shading, additional clearing may be required. Clearing trees from a site already relatively inaccessible, however, may not be feasible. A possible option to consider is to pole-mount the arrays. One three foot steel pole, 20 foot in height can hold a 4 panel-bed and costs run approximately $80 per pole. Eight poles would be needed and costs for support structures for a pole-mounted system are the same as those for a ground-mounted system. Figures D-1 and D-2 illustrate typical ground and pole-mounted systems, respectively.

Also, to prevent vandalism and theft, particularly for a ground mounted system, AEE strongly recommends fencing the area. For further protection against the weather, it is recommended that the battery bank be buried in an oversize, insulated and vented box, situated inside a shed for shelter against rain and snow.

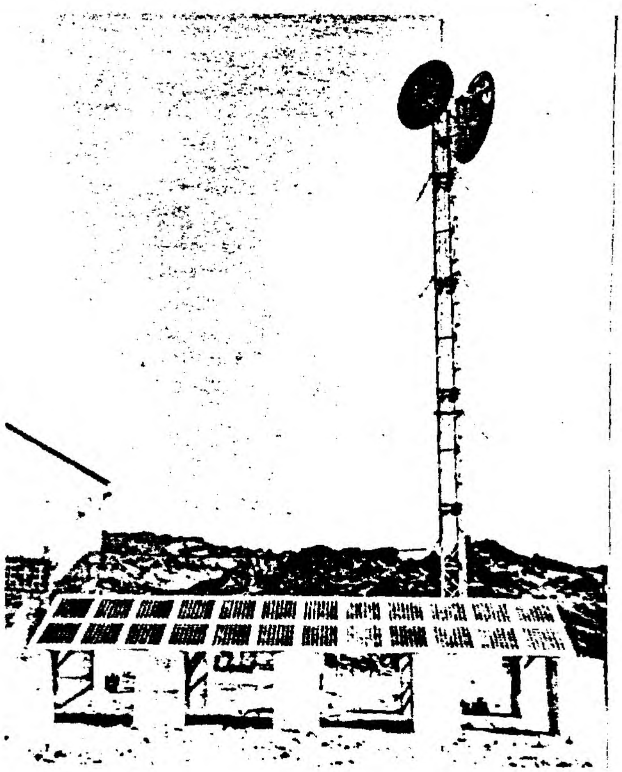
The overall system has been configured to require periodic checks on the order of every three months. Specifically, battery fluid levels need to be checked periodically and arrays need to be inspected for their general condition. The system then provides renewable power for the specified functions for the life of the batteries.

The power requirements for the repeater sites are less than those for the Hinch Mountain facility. A microwave repeater which will satisfy transmission requirements is available from GTE Lenkurt which requires 300 mA in the redundant mode. Such a low power requirement would be more than met by a small panel which can be installed on the tower itself. One 12 V deep discharge battery would provide all the storage required for the operation of the repeater. GTE offers a redundant solar panel for the low power RF repeater at a cost of $1685.

A PV system equipment list with related costs is presented in Table D-1.

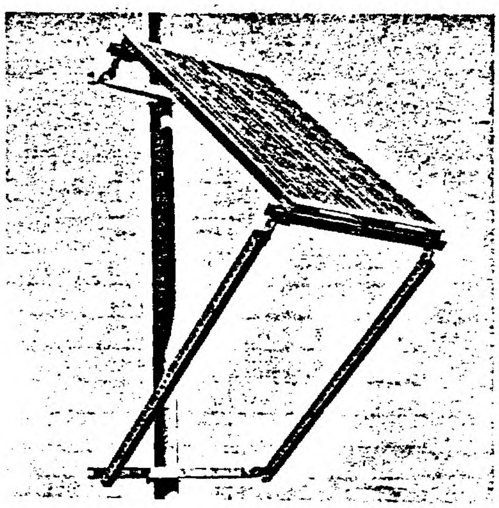


Typical Ground Mount Structure

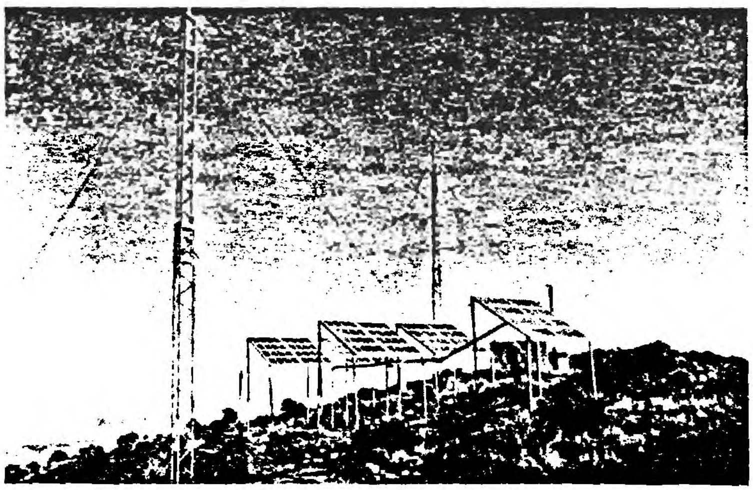


800 Watt Microwave Repeater System with
Ground Mount Installation on Concrete

Figure D-1. Ground-Mounted Array System.



Typical Pole Mount Structure



1600 Watt Missile Control and Tracking System (U.S. Army) with Pole Mounted System on Metal Stilts

Figure D-2. Pole-Mounted Array System.

TABLE D-1

PHOTOVOLTAIC EQUIPMENT CHARACTERISTICS AND COST

SITE	SYSTEM	FUNCTIONAL LOAD: EQUIPMENT	FUNCTIONAL LOAD: VENDOR[2]	FUNCTIONAL LOAD: COST	PHOTOVOLTAIC SYSTEM[1]: PANELS	PHOTOVOLTAIC SYSTEM[1]: BATTERIES	PHOTOVOLTAIC SYSTEM[1]: AREA	PHOTOVOLTAIC SYSTEM[1]: COST
Hinch Mountain	Overall System	Tower lighting for structure 200' or more in height. Typical unit: FTB-119 (requires 24V DC input)(one lamp required per tower)	Flash Technology Corp.	$2,807 per unit	One bank of 8 panels, connected in parellel & bank, in series with 24V system described below.	4 deep discharge batteries in addition to those required for the 24V system.	32 sq.ft.	$4,000
	VHF	110W radio with DC input. Typical unit: C73-RTB 3105 (requires 12V DC input)	Motorola	$4,500 per unit	Two banks of 8 & 7 panels (panels in parellel; banks in series).	6 deep discharge 6V batteries for 12V DC source.	60 sq.ft.	$10,100
	Microwave	Radio unit requiring 24V DC input.	Motorola	$5,000 per unit	Two banks of 8 panels each (panels in parellel; banks in series).	8 deep discharge 6V batteries for 24V DC source/	64 sq.ft.	$9,300
Repeater Sites	Overall System	(No tower lighting required in most cases for structures less than 200')			---------	-------	-----	----
	VHF	(see Hinch Mountain above)			(see Hinch Mountain above)		(see above)	
	Microwave	Repeater (redundant) - Typical unit: 700F1 RF	GTE-Lenkurt	$10,400	One 20W panel (none if VHF system is also installed).	One 12V deep discharge battery (none if VHF system is installed).	-0- (can be pole mounted on tower)	$350

(1) PV systems were sized and priced by Alternative Energy Engineering, P.O. Box 339, Redway, CA, 95560. However, it should be pointed out that AEE estimates were used to typify moderately priced PV systems. Other companies which provide PV power systems include Solarex, Motorola, and GTE.

(2) Vendors and units specified are to be considered examples of manufacturers and equipment available in the marketplace which meet the specific requirements of a PV-powered system.

(3) Radio units listed here represent the <u>portion</u> of the equipment required to meet PV-system needs (ie: DC input). Complete generic system requirements are discussed in the text of this report.

<u>Additional Considerations</u>:

1. System should be fenced to protect against vandalism and theft.
2. If shading dictates pole-mounting, 3", 20' steel poles are one recommended means. One pole is required per four panels. To reduce shipping charges, poles, in addition to batteries, should be purchased from a local source. Costs for poles have been estimated at $80.00 each.
3. The battery bank should be buried in an insulated, oversize box which is vented to provide some thermal protection, thereby adding to the overall efficiency of the system. The bank and regulators should be protected by a small equipment shed against precipitation.

MICROWAVE SYSTEM DESIGN
AND INTERFERENCE ANALYSIS

By

R.W. Rice

July 1982

Prepared for

VOLUNTEER ELECTRIC COOPERATIVE
Decatur, Tennessee

Contract A-2463

Georgia Institute of Technology
A Unit of the University System of Georgia
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1. Introduction

This report defines the technical parameters associated with a seventeen (17) node microwave network designed for Volunteer Electric Cooperative of Decatur Tennessee. The major thrust of this report is in the area of frequency selection for the purpose of interference (both intra- and inter-system) control. For this analysis, the procedures for evaluating switchable carrier-to-interference ratios (CTRs) defined in Electronics Industries Bulletin 10-C have been used exclusively. Also, where it became necessary to evaluate the influence of terrain on propagation loss, the Longley-Rice propagation model as described in National Bureau of Standards Technical Note 001 was used.

2. Link Analysis

In this section the results of the initial link analysis are presented. These results fall into two major groups: transmitter power, antenna gain requirements, and tower height requirements. The former are determined by analytical techniques reflecting path losses, required fade margins, and known receiver sensitivity. The latter is achieved primarily through graphical techniques using terrain profile data, estimated vegetation heights, and calculated Fresnel zone clearance requirements. The results for each link are presented individually below. The locations of the network nodes are defined in Table 2-1.

In large part, the results that follow are based upon calculated separation distances between two network nodes and the antenna pointing angles for the path connecting the two nodes. This has been evaluated for all network node combinations, and the results are presented in Appendix A.

TABLE 2-1

VEC NETWORK NODE LOCATIONS

NODE NUMBER	NODE NAME	LATITUDE (^{o}N)	LONGITUDE (^{o}W)
1	Hamilton County	35.215	85.031389
2	White Oak Mtn.	35.149444	85.023333
3	Cleveland Repeater	35.230556	84.863056
4	Oswald Dome	35.1925	84.558889
5	Cleveland Office	35.215	84.830278
6	Benton	35.168056	84.657222
7	Decatur East	35.5175	84.779167
8	Decatur Office	35.5175	84.789444
9	Grandview	35.730278	84.851389
10	Spring City	35.687778	84.863056
11	Renegade	35.885	84.859444
12	Crossville	35.941667	85.02
13	Isoline	36.10	85.038611
14	Monterey	36.142778	85.270833
15	Double Top	36.491389	85.03
16	Jamestown	36.426944	84.930556
17	Byrdstown	36.570278	85.130278

Hamilton County Office (1)-to-White Oak Mtn. (2)

Table 2-2 summarizes the link budget factors for this path and from Figure 2-1 the antenna characteristics may be determined. The antenna characteristics are summarized in Table 2-3.

TABLE 2-2

LINK BUDGET FOR HAMILTON COUNTY (1) TO
WHITE OAK MOUNTAIN (2) PATH

PATH LENGTH (STATUTE MILES): 4.54

PATH LOSS (LP): 116.4 dB

MINIMUM SIGNAL (SM): -94 dBm

FADE MARGIN (MF): 20 dB

LINE LOSSES (LL): 10 dB

REQUIRED SYSTEM

GAIN (LP + SM + MF + LL = GS): 52.4 dB

ANTENNA GAIN (GA): 2 x 33 dB = 66 dB

REQUIRED TRANSMITTER

POWER (PT = GS - GA): -13.6 dBm

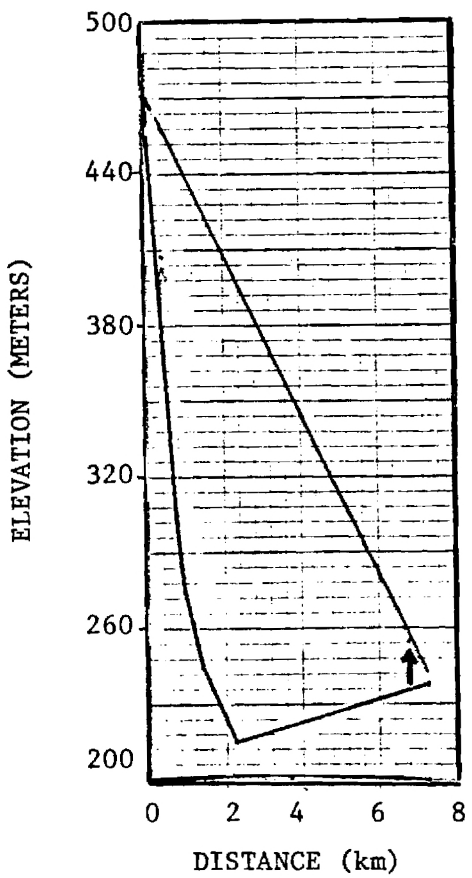


Figure 2-1. Profile for White Oak Mountain - Hamilton County Office path.

TABLE 2-3

ANTENNA SYSTEM CHARACTERISTICS FOR
HAMILTON COUNTY (1) TO WHITE OAK MTN. (2) PATH

	SITE	
PARAMETER	HAMILTON COUNTY	WHITE OAK MOUNTAIN
ANTENNA TYPE	CATEGORY A	CATEGORY A
ANTENNA GAIN (dB)	33	33
CROSS POLARIZATION DISCRIMINATION (dB)	37	37
HEADING (DEGREES)	174.260	354.261
HEIGHT ABOVE GROUND (METERS)	6	15

White Oak Mtn. (2)-to-Cleveland Repeater (3)

Table 2-4 summarizes the link budget factors for this path and from Figure 2-2 the antenna characteristics may be determined. The antenna characteristics are summarized in Table 2-5. The antenna height above ground figures in this case are determined by the local tree line which is assumed to be 15 meters high. If it is possible to clear the local vegetation so that a clear path exists for the link, than the antennas can be placed very close to ground.

TABLE 2-4

LINK BUDGET FOR WHITE OAK MOUNTAIN (2) TO CLEVELAND REPEATER (3) PATH

PATH LENGTH (STATUTE MILES): 10.6

PATH LOSS (LP): 123.8 dB

MINIMUM SIGNAL (SM): -94 dBm

FADE MARGIN (MF): 25 dB

LINE LOSSES (LL): 10 dB

REQUIRED SYSTEM

GAIN (LP + SM + MF + LL = GS): 64.8 dB

ANTENNA GAIN (GA): 2 x 33 dB = 66.0 dB

REQUIRED TRANSMITTER

POWER (PT = GS - GA): -1.2 dBm

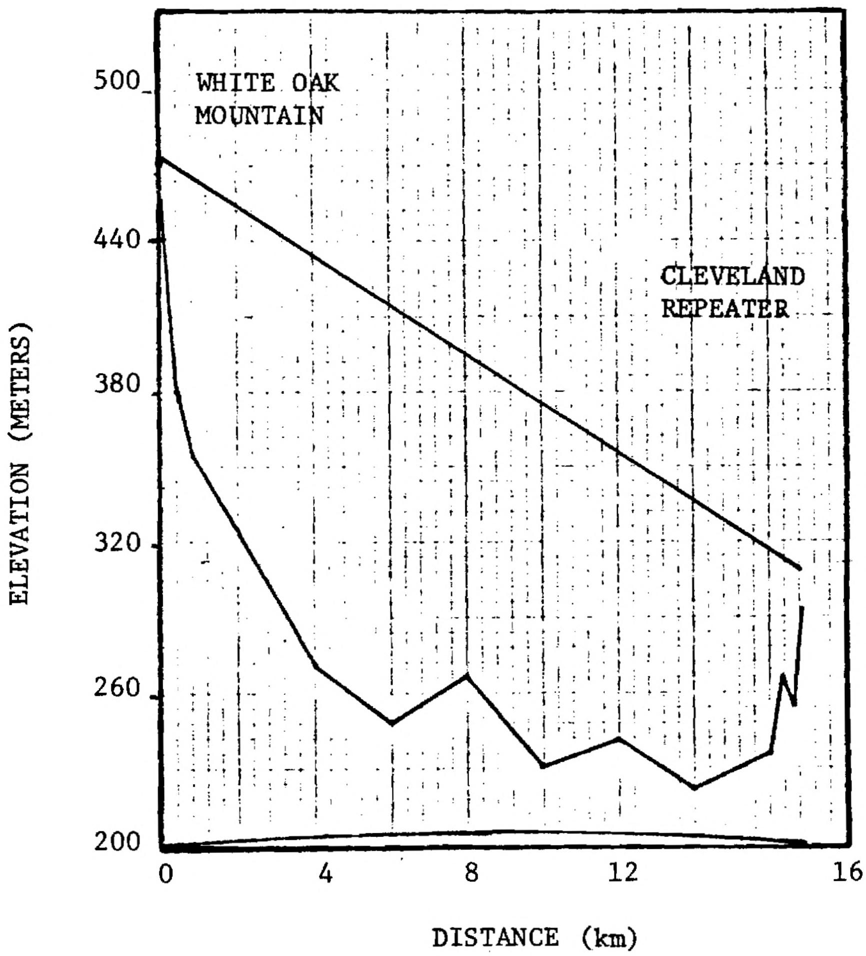


Figure 2-2. Profile for White Oak Mountain - Cleveland Repeater Path.

TABLE 2-5

ANTENNA SYSTEM CHARACTERISTICS FOR
WHITE OAK MOUNTAIN (2) TO CLEVELAND REPEATER (3) PATH

	SITE	
PARAMETER	WHITE OAK MTN (2)	CLEVELAND RPT (3)
ANTENNA TYPE	CATEGORY A	CATEGORY A
ANTENNA GAIN (dB)	33	33
CROSS POLARIZATION DISCRIMINATION (dB)	37	37
HEADING (DEGREES)	58.186	238.278
HEIGHT ABOVE GROUND (METERS)	15	15

Cleveland Repeater (3)-to-Cleveland Office (5)

Table 2-6 summarizes the link budget factors for this path and from Figure 2-3 the antenna characteristics may be determined. The antenna characteristics are summarized in Table 2-7.

TABLE 2-6

LINK BUDGET FOR CLEVELAND REPEATER (3) TO
CLEVELAND OFFICE (5) PATH

PATH LENGTH (STATUTE MILES): 2.13

PATH LOSS (LP): 109.8 dB

MINIMUM SIGNAL (SM): -94 dBm

FADE MARGIN (MF): 20 dB

LINE LOSSES (LL): 10 dB

REQUIRED SYSTEM

GAIN (LP + SM + MF + LL = GS): 45.8 dB

ANTENNA GAIN (GA): 2 x 33 dB = 66 dB

REQUIRED TRANSMITTER

POWER (PT = GS - GA): -20.2 dBm

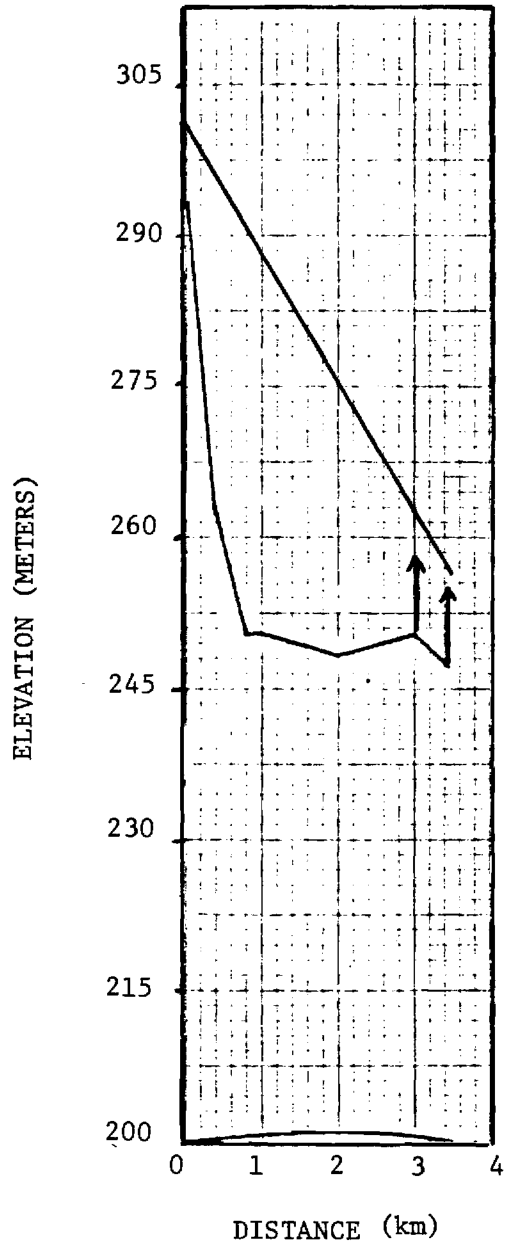


Figure 2-3. Profile of Cleveland Repeater Cleveland Office Path.

TABLE 2-7

ANTENNA SYSTEM CHARACTERISTICS FOR
CLEVELAND REPEATER (3) TO CLEVELAND OFFICE (5) PATH

	SITE	
PARAMETER	CLEVELAND RPT (3)	CLEVELAND OFFICE (5)
ANTENNA TYPE	CATEGORY A	CATEGORY A
ANTENNA GAIN (dB)	33	33
CROSS POLARIZATION DISCRIMINATION (dB)	37	37
HEADING (DEGREES)	120.145	300.164
HEIGHT ABOVE GROUND (METERS)	6	15

White Oak Mtn. (2)-to-Oswald Dome (4)

Table 2-8 summarizes the link budget factors for this path and from Figure 2-4 the antenna characteristics may be determined. The antenna characteristics are summarized in Table 2-9. The antenna height above ground figures in this case are determined by the local tree line which is assumed to be 15 meters high. If it is possible to clear the local vegetation so that a clear path exists for this link, then the antennas can be placed very close to ground.

TABLE 2-8

LINK BUDGET FOR WHITE OAK MTN (2) TO
OSWALD DOME (4) PATH

PATH LENGTH (STATUTE MILES): 26.36

PATH LOSS (LP): 131.7 dB

MINIMUM SIGNAL (SM): -94 dBm

FADE MARGIN (MF): 40 dB

LINE LOSSES (LL): 10 dB

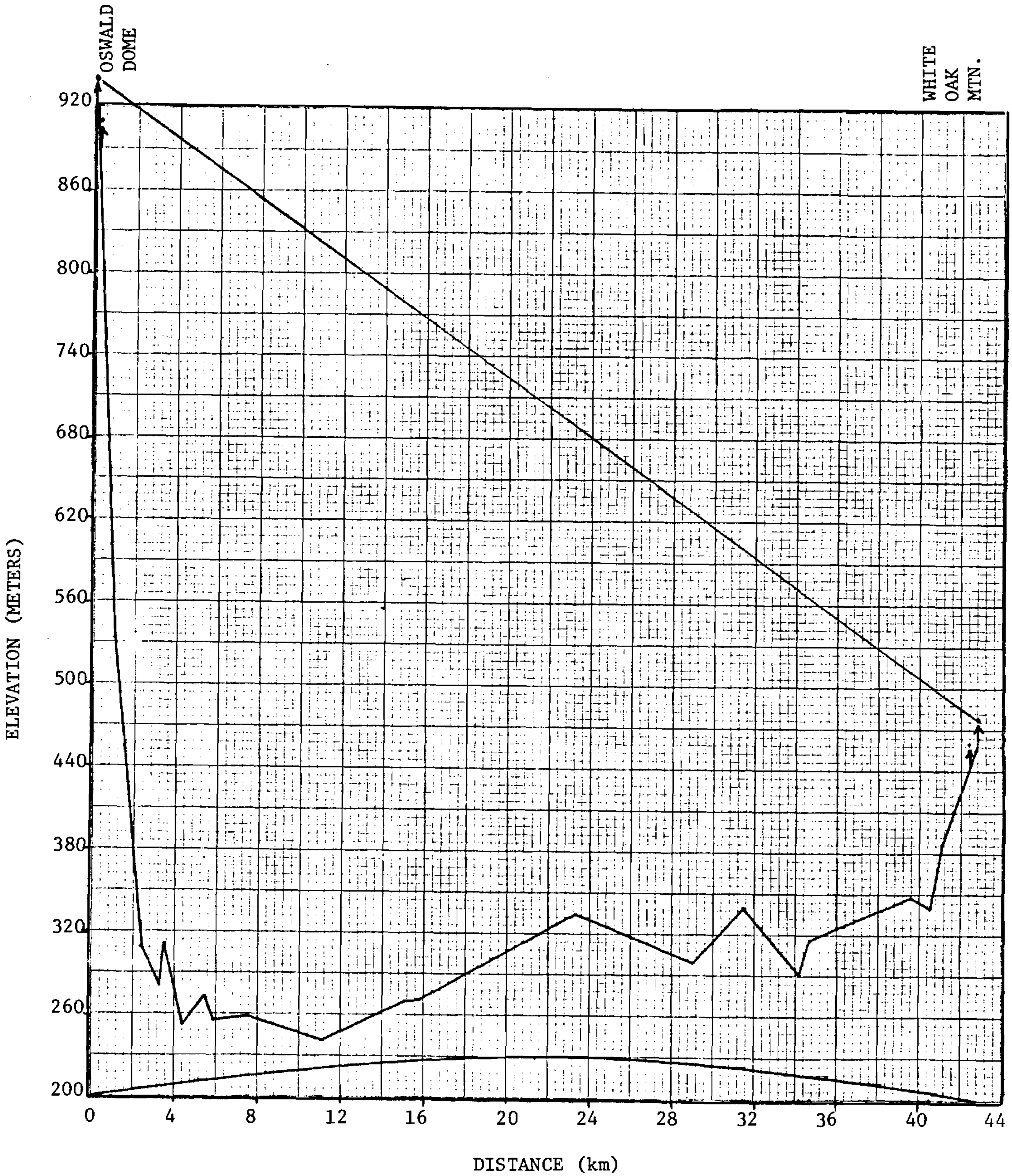
REQUIRED SYSTEM

GAIN (LP + SM + MF + LL = GS): 87.7 dB

ANTENNA GAIN (GA): 2 x 33 dB = 66 dB

REQUIRED TRANSMITTER

POWER (PT = GS - GA): 21.7 dBm



Figue 2-4. Profile for White Oak Mountain to Oswald Dome path.

TABLE 2-9

ANTENNA SYSTEM CHARACTERISTICS FOR
WHITE OAK MTN (2) TO OSWALD DOME (4) PATH

	SITE	
PARAMETER	WHITE OAK MTN (2)	OSWALD DOME (4)
ANTENNA TYPE	CATEGORY A	CATEGORY A
ANTENNA GAIN (dB)	33	33
CROSS POLARIZATION DISCRIMINATION (dB)	37	37
HEADING (DEGREES)	83.396	263.664
HEIGHT ABOVE GROUND (METERS)	15	15

Oswald Dome (4)-to-Benton (6)

Table 2-10 summarizes the link budget factors for this path and from Figure 2-5 the antenna characteristics may be determined. The antenna characteristics are summarized in Table 2-11.

TABLE 2-10

LINK BUDGET FOR OSWALD DOME (4) TO
BENTON (6) PATH

PATH LENGTH (STATUTE MILES): 5.80

PATH LOSS (LP): 118.5 dB

MINIMUM SIGNAL (SM): -94 dBm

FADE MARGIN (MF): 20 dB

LINE LOSSES (LL): 10 dB

REQUIRED SYSTEM

GAIN (LP + SM + MF + LL = GS): 54.5 dB

ANTENNA GAIN (GA): 2 x 33 dB = 66 dB

REQUIRED TRANSMITTER

POWER (PT = GS - GA): -11.5 dBm

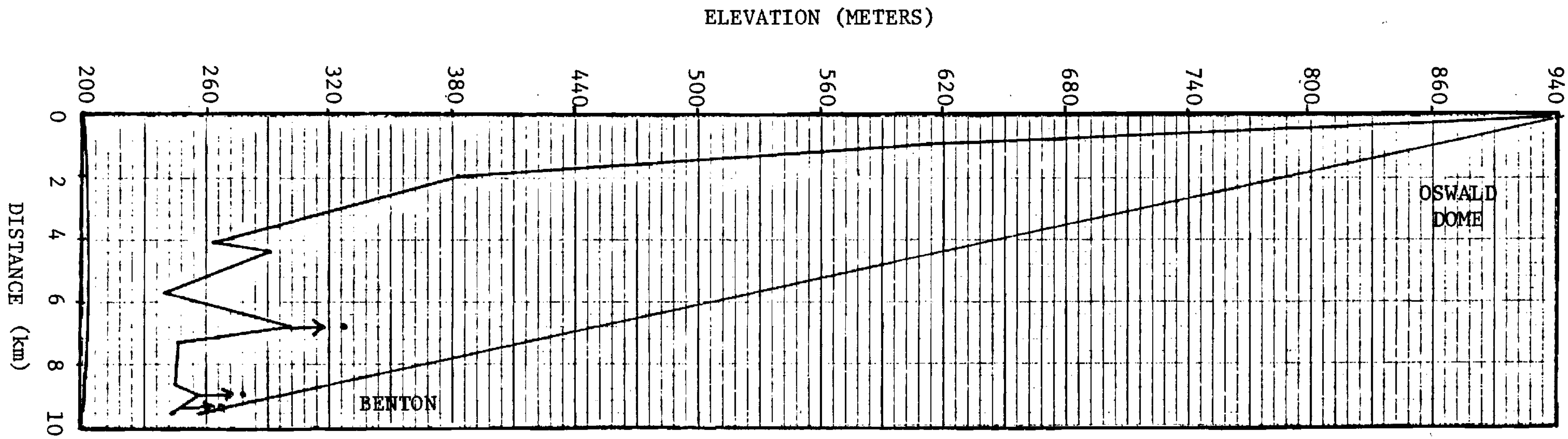


Figure 2-5. Profile of Oswald Dome - Benton path.

TABLE 2-11

ANTENNA SYSTEM CHARACTERISTICS FOR
OSWALD DOME (4) TO BENTON (6) PATH

	SITE	
PARAMETER	OSWALD DOME (4)	BENTON (6)
ANTENNA TYPE	CATEGORY A	CATEGORY A
ANTENNA GAIN (dB)	33	33
CROSS POLARIZATION DISCRIMINATION (dB)	37	37
HEADING (DEGREES)	253.112	73.055
HEIGHT ABOVE GROUND (METERS)	15	12

Oswald Dome (4)-to-Decatur East (7)

Table 2-12 summarizes the link budget factors for this path and from Figure 2-6 the antenna characteristics may be determined. The antenna characteristics are summarized in Table 2-13. The antenna height above ground figures in this case are determined by the local tree line which is assumed to be 15 meters high. If it is possible to clear the local vegetation so that a clear path exists for the link, then the antennas can be placed very close to the ground.

TABLE 2-12

LINK BUDGET FOR OSWALD DOME (4) TO
DECATUR EAST (7) PATH

PATH LENGTH (STATUTE MILES): 25.62

PATH LOSS (LP): 131.4 dB

MINIMUM SIGNAL (SM): -94 dBm

FADE MARGIN (MF): 40 dB

LINE LOSSES (LL): 10 dB

REQUIRED SYSTEM

GAIN (LP + SM + MF + LL = GS): 87.4 dB

ANTENNA GAIN (GA): 2 x 33 dB = 66 dB

REQUIRED TRANSMITTER

POWER (PT = GS - GA): -21.4 dBm

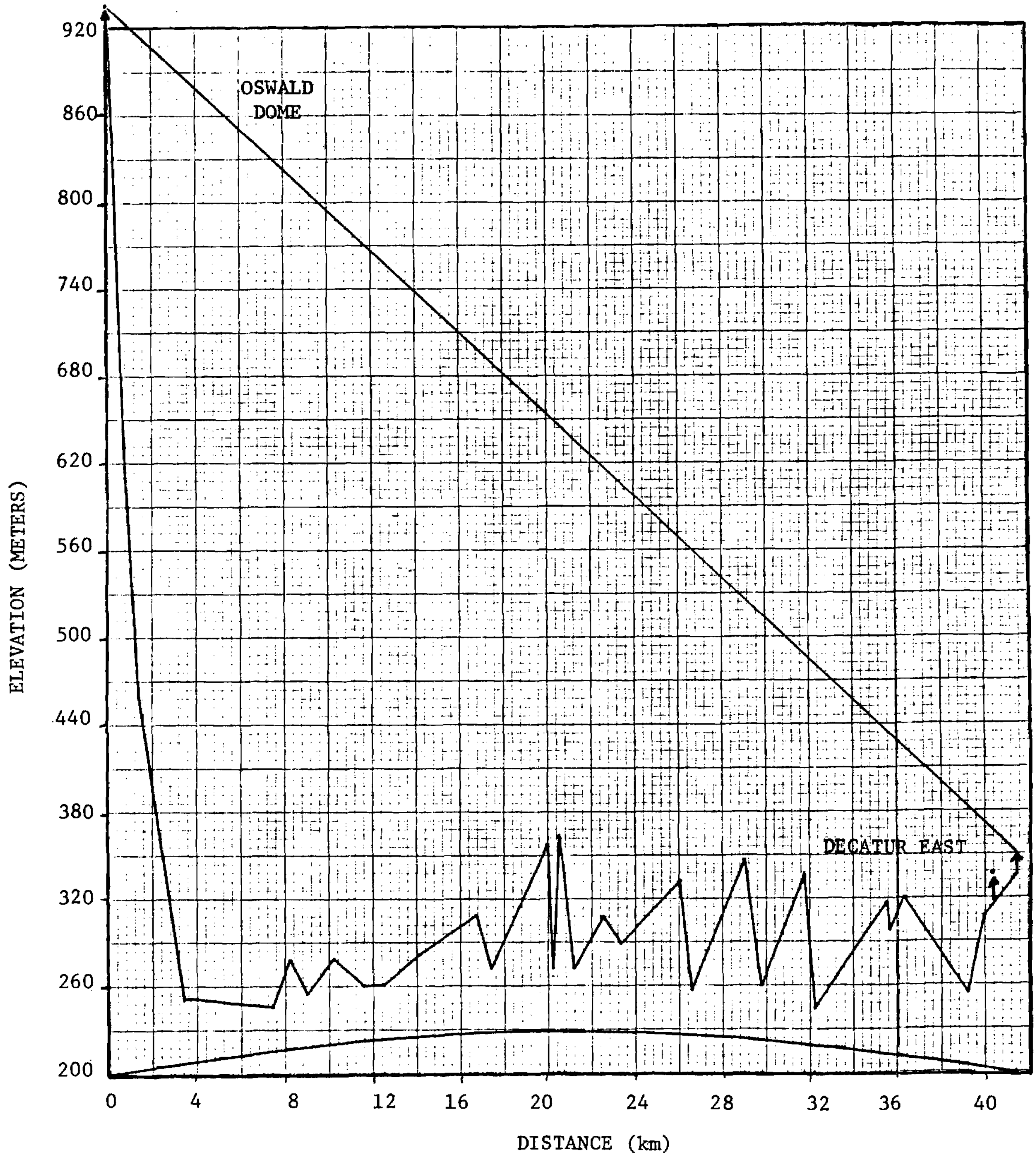


Figure 2-6. Profile of Oswald Dome - Decatur East path.

TABLE 2-13

ANTENNA SYSTEM CHARACTERISTICS FOR
OSWALD DOME (4) TO DECATUR EAST (7) PATH

	SITE	
PARAMETER	OSWALD DOME (4)	DECATUR EAST (7)
ANTENNA TYPE	CATEGORY A	CATEGORY A
ANTENNA GAIN (dB)	33	33
CROSS POLARIZATION DISCRIMINATION (dB)	37	37
HEADING (DEGREES)	331.131	151.003
HEIGHT ABOVE GROUND (METERS)	15	15

Decatur East (7)-to-Decatur Office (8)

Table 2-14 summarizes the link budget factors for this path and from Figure 2-7 the antenna characteristics may be determined. The antenna characteristics are summarized in Table 2-15.

TABLE 2-14

LINK BUDGET FOR DECATUR EAST (7) TO
DECATUR OFFICE (8) PATH

PATH LENGTH (STATUTE MILES): 0.55

PATH LOSS (LP): 98.1 dB

MINIMUM SIGNAL (SM): -94 dBm

FADE MARGIN (MF): 20 dB

LINE LOSSES (LL): 10 dB

REQUIRED SYSTEM

GAIN (LP + SM + MF + LL = GS): 34.1 dB

ANTENNA GAIN (GA): 2 x 33 dB = 66 dB

REQUIRED TRANSMITTER

POWER (PT = GS - GA): -31.9 dBm

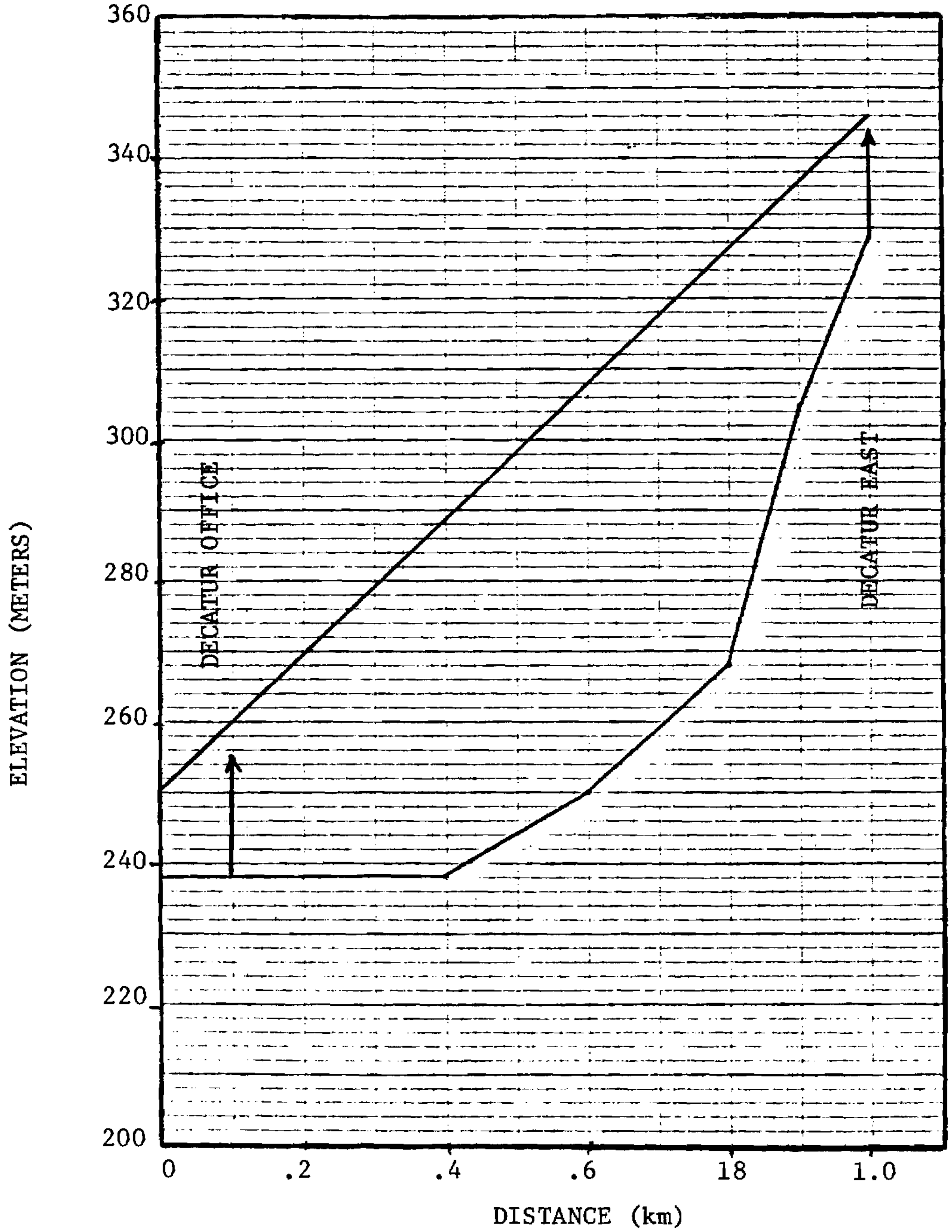


Figure 2-7. Profile for Decatur Office - Decatur East path.

TABLE 2-15

ANTENNA SYSTEM CHARACTERISTICS FOR
DECATUR EAST (7) TO DECATUR OFFICE (8) PATH

	SITE	
PARAMETER	DECATUR EAST (7)	DECATUR OFFICE (8)
ANTENNA TYPE	CATEGORY A	CATEGORY A
ANTENNA GAIN (dB)	33	33
CROSS POLARIZATION DISCRIMINATION (dB)	37	37
HEADING (DEGREES)	270.000	90.000
HEIGHT ABOVE GROUND (METERS)	17	12

Decatur East (7)-to-Grandview (9)

Table 2-16 summarizes the link budget factors for this path and from Figure 2-8 the antenna characteristics may be determined. The antenna characteristics are summarized in Table 2-17.

TABLE 2-16

LINK BUDGET FOR DECATUR EAST (7) TO
GRANDVIEW (9) PATH

PATH LENGTH (STATUTE MILES): 15.23

PATH LOSS (LP): 126.9 dB

MINIMUM SIGNAL (SM): -94 dBm

FADE MARGIN (MF): 40 dB

LINE LOSSES (LL): 10 dB

REQUIRED SYSTEM

GAIN (LP + SM + MF + LL = GS): 82.9 dB

ANTENNA GAIN (GA): 2 x 33 dB = 66 dB

REQUIRED TRANSMITTER

POWER (PT = GS - GA): 16.9 dBm

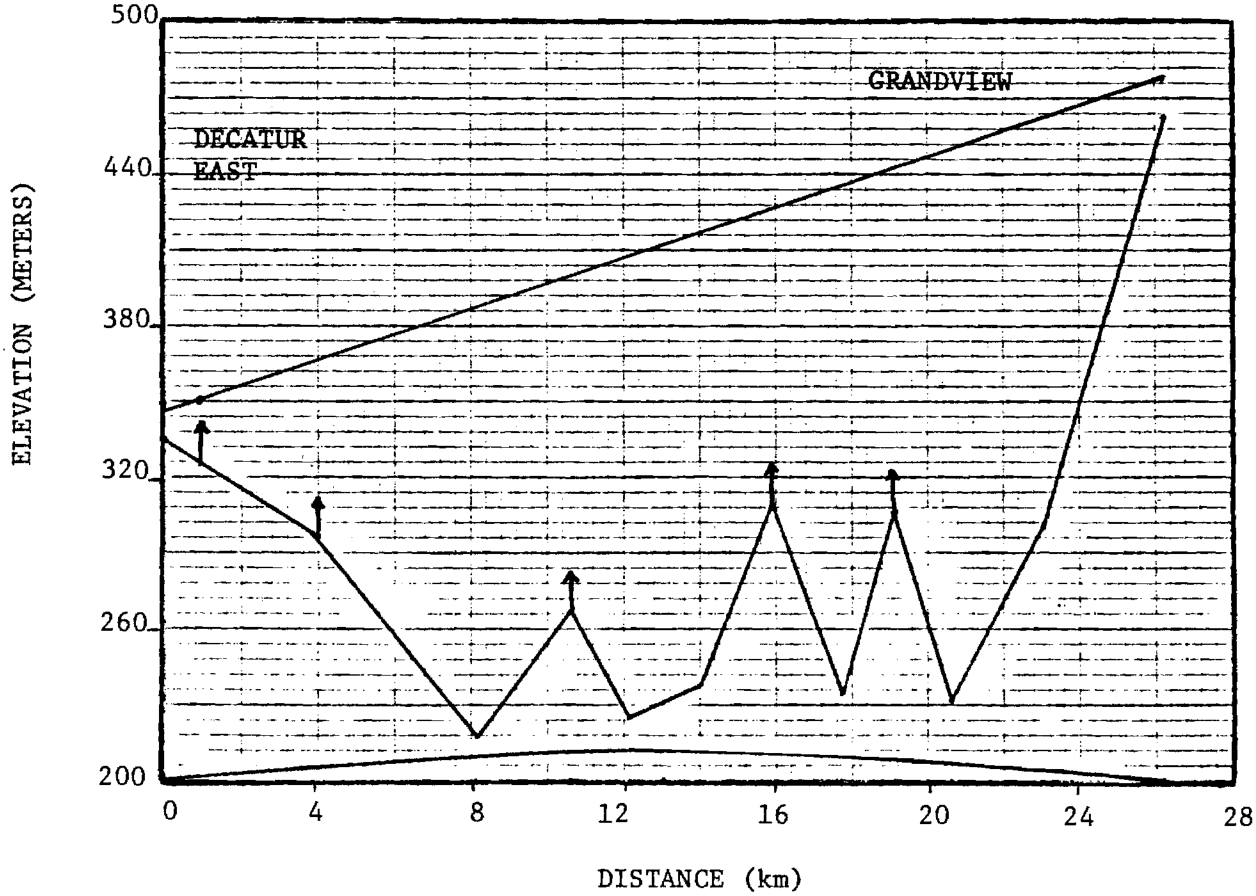


Figure 2-8. Profile for Decatur East - Grandview path.

TABLE 2-17

ANTENNA SYSTEM CHARACTERISTICS FOR
DECATUR EAST (7) TO GRANDVIEW (9) PATH

	SITE	
PARAMETER	DECATUR EAST (7)	GRANDVIEW (9)
ANTENNA TYPE	CATEGORY A	CATEGORY A
ANTENNA GAIN (dB)	33	33
CROSS POLARIZATION DISCRIMINATION (dB)	37	37
HEADING (DEGREES)	344.597	164.555
HEIGHT ABOVE GROUND (METERS)	12	15

Grandview (9)-to-Spring City (10)

Table 2-18 summarizes the link budget factors for this path and from Figure 2-9 the antenna characteristics may be determined. The antenna characteristics are summarized in Table 2-19. The antenna height above ground figures in this case are determined by the local tree line which is assumed to be 15 meters high. If it is possible to clear the local vegetation so that a clear path exists for the link, then the antennas can be placed very close to ground.

TABLE 2-18

LINK BUDGET FOR GRANDVIEW (9) TO
SPRING CITY (10) PATH

PATH LENGTH (STATUTE MILES): 3.0

PATH LOSS (LP): 112.8 dB

MINIMUM SIGNAL (SM): -94 dBm

FADE MARGIN (MF): 20 dB

LINE LOSSES (LL): 10 dB

REQUIRED SYSTEM

GAIN (LP + SM + MF + LL = GS): 48.8 dB

ANTENNA GAIN (GA): 2 x 33 dB = 66 dB

REQUIRED TRANSMITTER

POWER (PT = GS - GA): -17.2 dBm

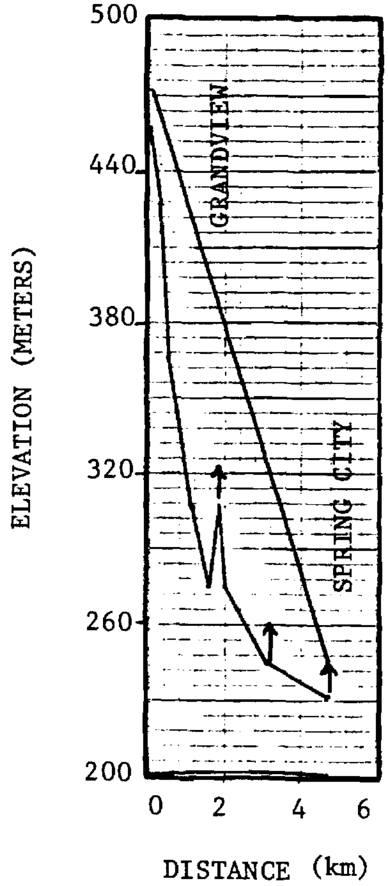


Figure 2-9. Profile for Grandview - Spring City path.

TABLE 2-19

ANTENNA SYSTEM CHARACTERISTICS FOR
GRANDVIEW (9) TO SPRING CITY (10) PATH

	SITE	
PARAMETER	GRANDVIEW (9)	SPRING CITY (10)
ANTENNA TYPE	CATEGORY A	CATEGORY A
ANTENNA GAIN (dB)	33	33
CROSS POLARIZATION DISCRIMINATION (dB)	37	37
HEADING (DEGREES)	192.570	12.563
HEIGHT ABOVE GROUND (METERS)	15	15

Grandview (9)-to-Renegade (11)

Table 2-20 summarizes the link budget factors for this path and from Figure 2-10 the antenna characteristics may be determined. The antenna characteristics are summarized in Table 2-21.

TABLE 2-20

LINK BUDGET FOR GRANDVIEW (9) TO
RENEGADE (11) PATH

PATH LENGTH (STATUTE MILES): 10.68

PATH LOSS (LP): 123.8 dB

MINIMUM SIGNAL (SM): -94 dBm

FADE MARGIN (MF): 35 dB

LINE LOSSES (LL): 10 dB

REQUIRED SYSTEM

GAIN (LP + SM + MF + LL = GS): 74.8 dB

ANTENNA GAIN (GA): 2 x 33 dB = 66 dB

REQUIRED TRANSMITTER

POWER (PT = GS - GA): 8.8 dBm

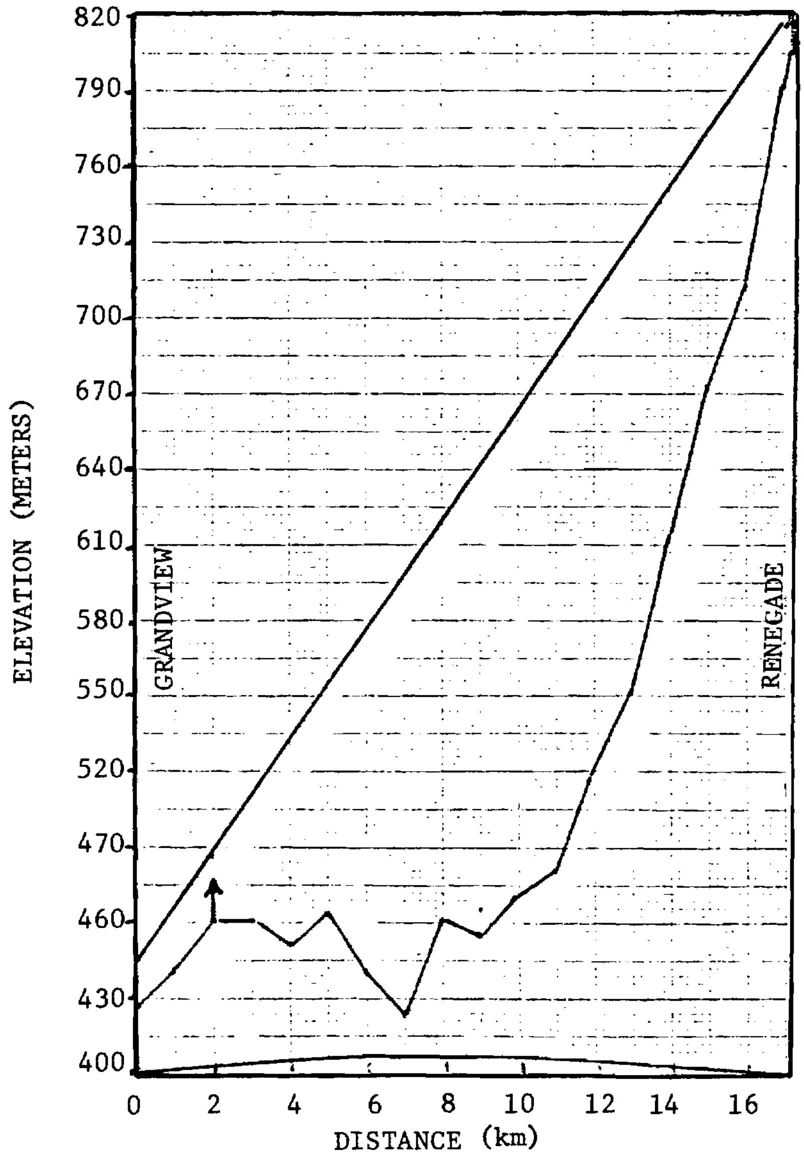


Figure 2-10. Profile for Grandview-to-Renegade Path.

TABLE 2-21

ANTENNA SYSTEM CHARACTERISTICS FOR
GRANDVIEW (9) TO RENEGADE (11) PATH

	SITE	
PARAMETER	GRANDVIEW (9)	RENEGADE (11)
ANTENNA TYPE	CATEGORY A	CATEGORY A
ANTENNA GAIN (dB)	33	33
CROSS POLARIZATION DISCRIMINATION (dB)	37	37
HEADING (DEGREES)	357.585	177.580
HEIGHT ABOVE GROUND (METERS)	18	15

Renegade (11)-to-Grossville (12)

Table 2-22 summarizes the link budget factors for this path and from Figure 2-11 the antenna characteristics may be determined. The antenna characteristics are summarized in Table 2-23.

TABLE 2-22

LINK BUDGET FOR RENEGADE (11) TO
CROSSVILLE (12) PATH

PATH LENGTH (STATUTE MILES): 9.79

PATH LOSS (LP): 123.1 dB

MINIMUM SIGNAL (SM): -94 dBm

FADE MARGIN (MF): 35 dB

LINE LOSSES (LL): 10 dB

REQUIRED SYSTEM

GAIN (LP + SM + MF + LL = GS): 74.1 dB

ANTENNA GAIN (GA): 2 x 33 dB = 66 dB

REQUIRED TRANSMITTER

POWER (PT = GS - GA): 8.1 dBm

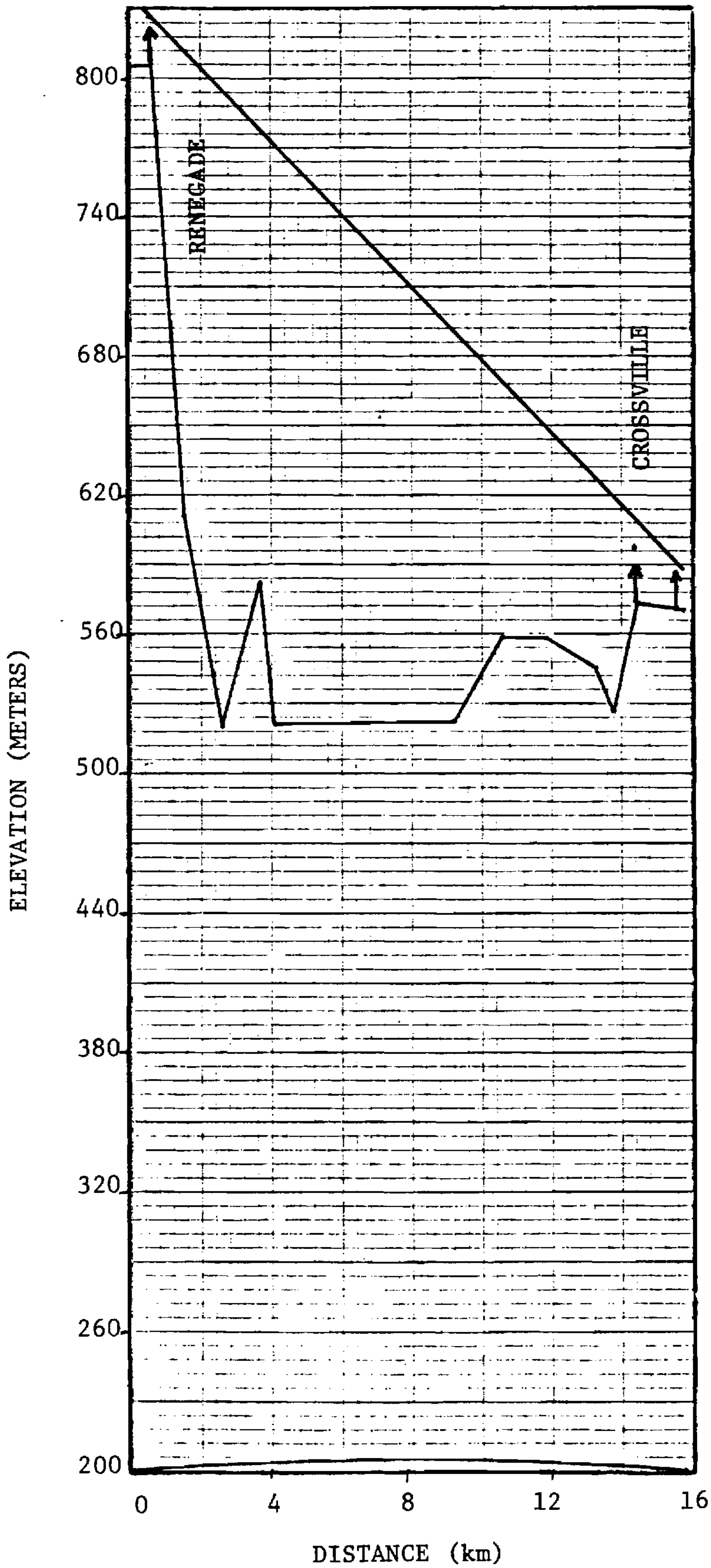


Figure 2-11. Profile for Renegade - Crossville path.

TABLE 2-23

ANTENNA SYSTEM CHARACTERISTICS FOR
RENEGADE (11) TO CROSSVILLE (12) PATH

	SITE	
PARAMETER	RENEGADE (11)	CROSSVILLE (12)
ANTENNA TYPE	CATEGORY A	CATEGORY A
ANTENNA GAIN (dB)	33	33
CROSS POLARIZATION DISCRIMINATION (dB)	37	37
HEADING (DEGREES)	293.594	113.500
HEIGHT ABOVE GROUND (METERS)	35	18

Renegade (11)-to-Isoline (13)

Table 2-24 summarizes the link budget factors for this path and from Figure 2-12 the antenna characteristics may be determined. The antenna characteristics are summarized in Table 2-25.

TABLE 2-24

LINK BUDGET FOR RENEGADE (11) TO
ISOLINE (13) PATH

PATH LENGTH (STATUTE MILES): 17.89

PATH LOSS (LP): 128.3 dB

MINIMUM SIGNAL (SM): -94 dBm

FADE MARGIN (MF): 40 dB

LINE LOSSES (LL): 10 dB

REQUIRED SYSTEM

GAIN (LP + SM + MF + LL = GS): 84.3 dB

ANTENNA GAIN (GA): 2 x 33 dB = 66 dB

REQUIRED TRANSMITTER

POWER (PT = GS - GA): 18.3 dBm

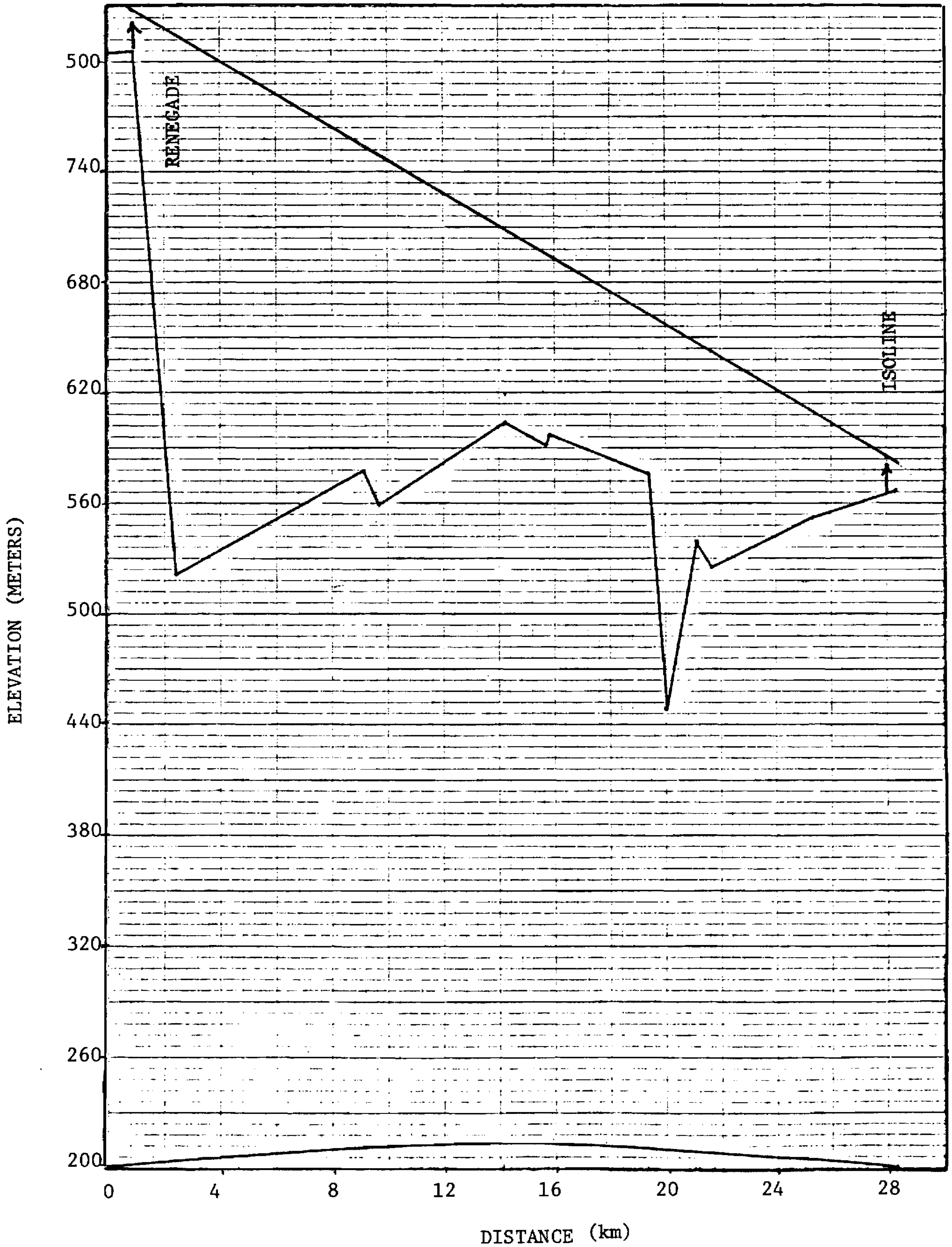


Figure 2-12. Profile for Renegade - Isoline path.

TABLE 2-25

ANTENNA SYSTEM CHARACTERISTICS FOR
RENEGADE (11) TO ISOLINE (13) PATH

PARAMETER	SITE: RENEGADE (11)	SITE: ISOLINE (13)
ANTENNA TYPE	CATEGORY A	CATEGORY A
ANTENNA GAIN (dB)	33	33
CROSS POLARIZATION DISCRIMINATION (dB)	37	37
HEADING (DEGREES)	326.063	145.958
HEIGHT ABOVE GROUND (METERS)	33	21

ISOLINE (13)-TO-MONTEREY (14)

Table 2-26 summarizes the link budget factors for this path and from Figure 2-13 the antenna characteristics may be determined. The antenna characteristics are summarized in Table 2-27.

TABLE 2-26

LINK BUDGET FOR ISOLINE (13) TO
MONTEREY (14) PATH

PATH LENGTH (STATUTE MILES): 13.27

PATH LOSS (LP): 125.7 dB

MINIMUM SIGNAL (SM): -94 dBm

FADE MARGIN (MF): 35 dB

LINE LOSSES (LL): 10 dB

REQUIRED SYSTEM

GAIN (LP + SM + MF + LL = GS): 76.7 dB

ANTENNA GAIN (GA): 2 x 33 dB = 66 dB

REQUIRED TRANSMITTER

POWER (PT = GS - GA): 10.7 dBm

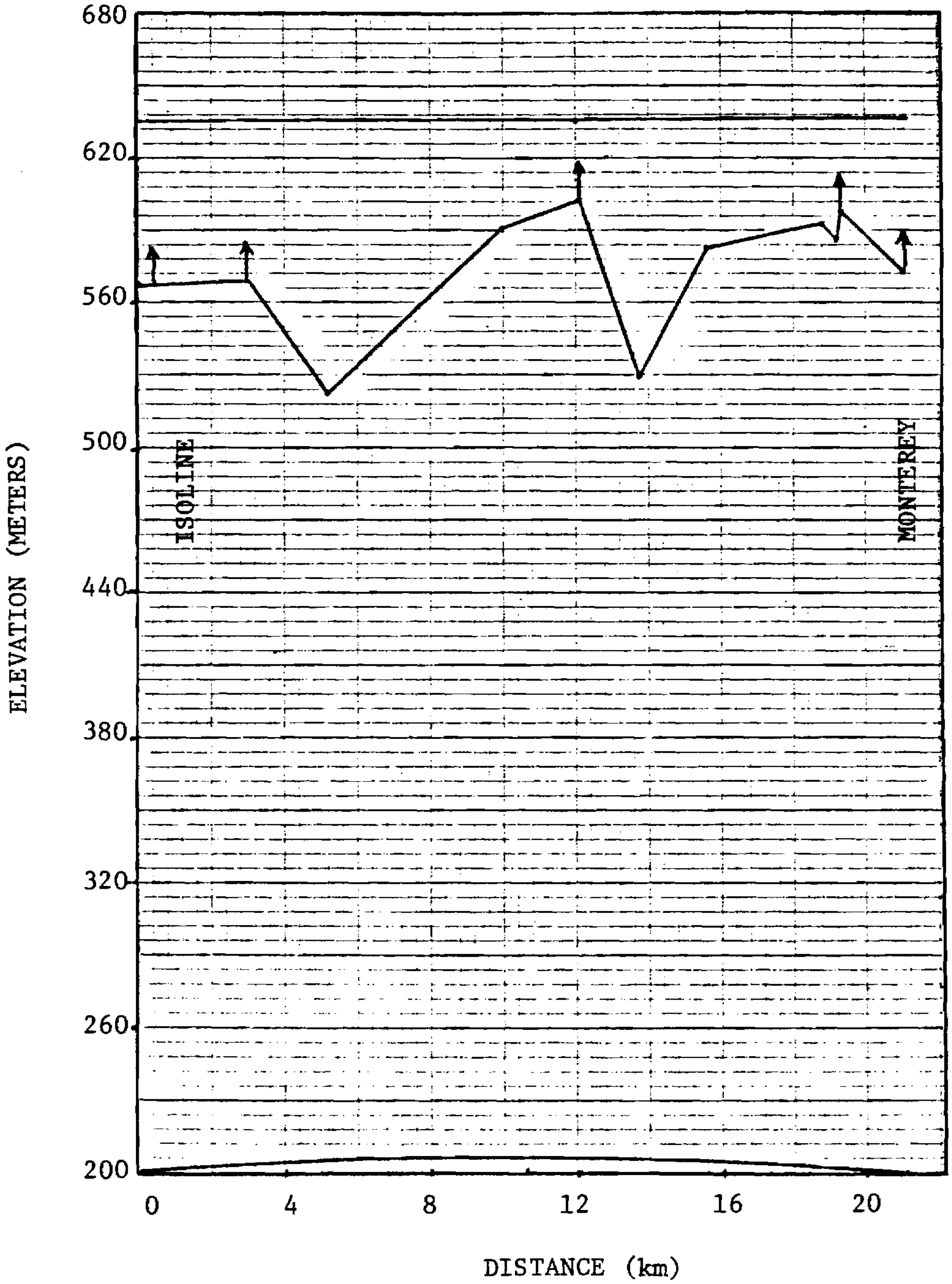


Figure 2-13. Profile of Isoline-Monterey path.

TABLE 2-27

ANTENNA SYSTEM CHARACTERISTICS FOR
ISOLINE (13) TO MONTEREY (14) PATH

	SITE	
PARAMETER	ISOLINE (13)	MONTEREY (14)
ANTENNA TYPE	CATEGORY A	CATEGORY A
ANTENNA GAIN (dB)	33	33
CROSS POLARIZATION DISCRIMINATION (dB)	37	37
HEADING (DEGREES)	282.915	102.778
HEIGHT ABOVE GROUND (METERS)	69	63

Isoline (13)-to-Double Top (15)

Table 2-28 summarizes the link budget factors for this path and from Figure 2-14 the antenna characteristics may be determined. The antenna characteristics are summarized in Table 2-29.

TABLE 2-28

LINK BUDGET FOR ISOLINE (13) TO
DOUBLE TOP (15) PATH

PATH LENGTH (STATUTE MILES): 27.01

PATH LOSS (LP): 131.9 dB

MINIMUM SIGNAL (SM): -94 dBm

FADE MARGIN (MF): 40 dB

LINE LOSSES (LL): 10 dB

REQUIRED SYSTEM

GAIN (LP + SM + MF + LL = GS): 87.9 dB

ANTENNA GAIN (GA): 2 x 33 dB = 66 dB

REQUIRED TRANSMITTER

POWER (PT = GS - GA): 21.9 dBm

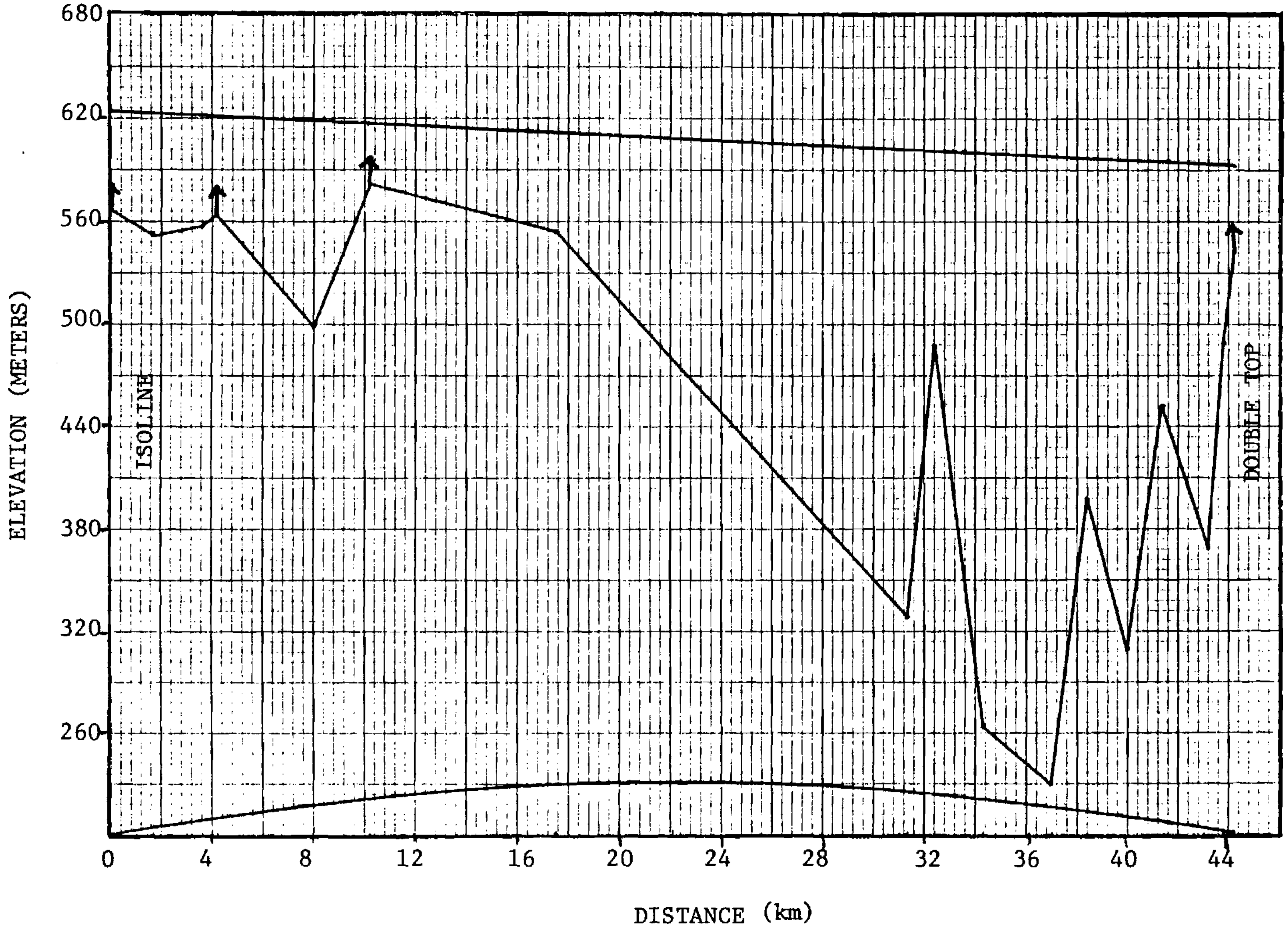


Figure 2-14. Profile for Isoline - Double Top path.

TABLE 2-29

ANTENNA SYSTEM CHARACTERISTICS FOR
ISOLINE (13) TO DOUBLE TOP (15) PATH

	SITE	
PARAMETER	ISOLINE (13)	DOUBLE TOP (15)
ANTENNA TYPE	CATEGORY A	CATEGORY A
ANTENNA GAIN (dB)	33	33
CROSS POLARIZATION DISCRIMINATION (dB)	37	37
HEADING (DEGREES)	1.013	181.018
HEIGHT ABOVE GROUND (METERS)	45	39

Double Top (15)-to-Jamestown (16)

Table 2-30 summarizes the link budget factors for this path and from Figure 2-15 the antenna characteristics may be determined. The antenna characteristics are summarized in Table 2-31.

TABLE 2-30

LINK BUDGET FOR DOUBLE TOP (15) TO JAMESTOWN (16) PATH

PATH LENGTH (STATUTE MILES): 7.08

PATH LOSS (LP): 120.3 dB

MINIMUM SIGNAL (SM): -94 dBm

FADE MARGIN (MF): 30 dB

LINE LOSSES (LL): 10 dB

REQUIRED SYSTEM

GAIN (LP + SM + MF + LL = GS): 66.3 dB

ANTENNA GAIN (GA): 2 x 33 dB = 66 dB

REQUIRED TRANSMITTER

POWER (PT = GS - GA): 0.3 dBm

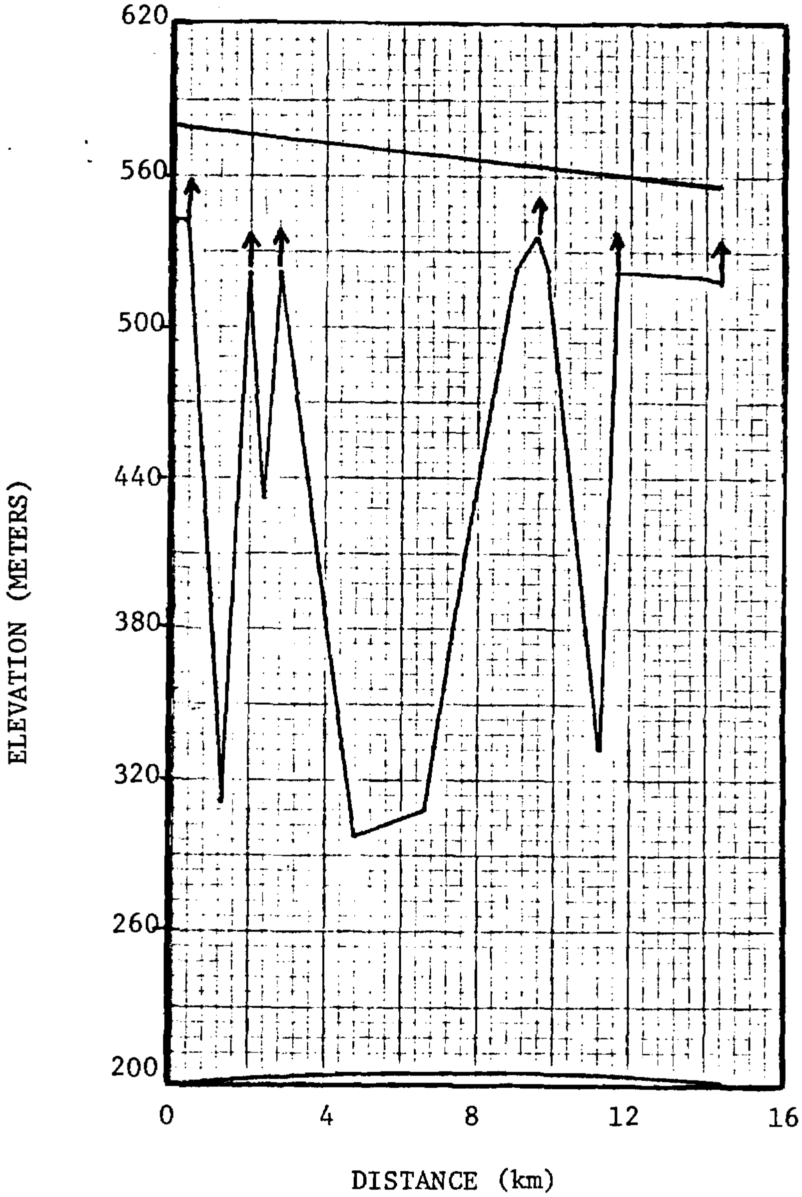


Figure 2-15. Profile of Double Top - Jamestown path.

TABLE 2-31

ANTENNA SYSTEM CHARACTERISTICS FOR
DOUBLE TOP (15) TO JAMESTOWN (16) PATH

	SITE	
PARAMETER	DOUBLE TOP (15)	JAMESTOWN (16)
ANTENNA TYPE	CATEGORY A	CATEGORY A
ANTENNA GAIN (dB)	33	33
CROSS POLARIZATION DISCRIMINATION (dB)	37	37
HEADING (DEGREES)	128.831	308.890
HEIGHT ABOVE GROUND (METERS)	39	39

Double Top (15)-to-Byrdstown (17)

Table 2-32 summarizes the link budget factors for this path and from Figure 2-16 the antenna characteristics may be determined. The antenna characteristics are summarized in Table 2-33.

TABLE 2-32

LINK BUDGET FOR DOUBLE TOP (15) TO
BYRDSTOWN (17) PATH

PATH LENGTH (STATUTE MILES): 7.77

PATH LOSS (LP): 121.1 dB

MINIMUM SIGNAL (SM): -94 dBm

FADE MARGIN (MF): 30 dB

LINE LOSSES (LL): 10 dB

REQUIRED SYSTEM

GAIN (LP + SM + MF + LL = GS): 67.1 dB

ANTENNA GAIN (GA): 2 x 33 dB = 66 dB

REQUIRED TRANSMITTER

POWER (PT = GS - GA): 1.1 dBm

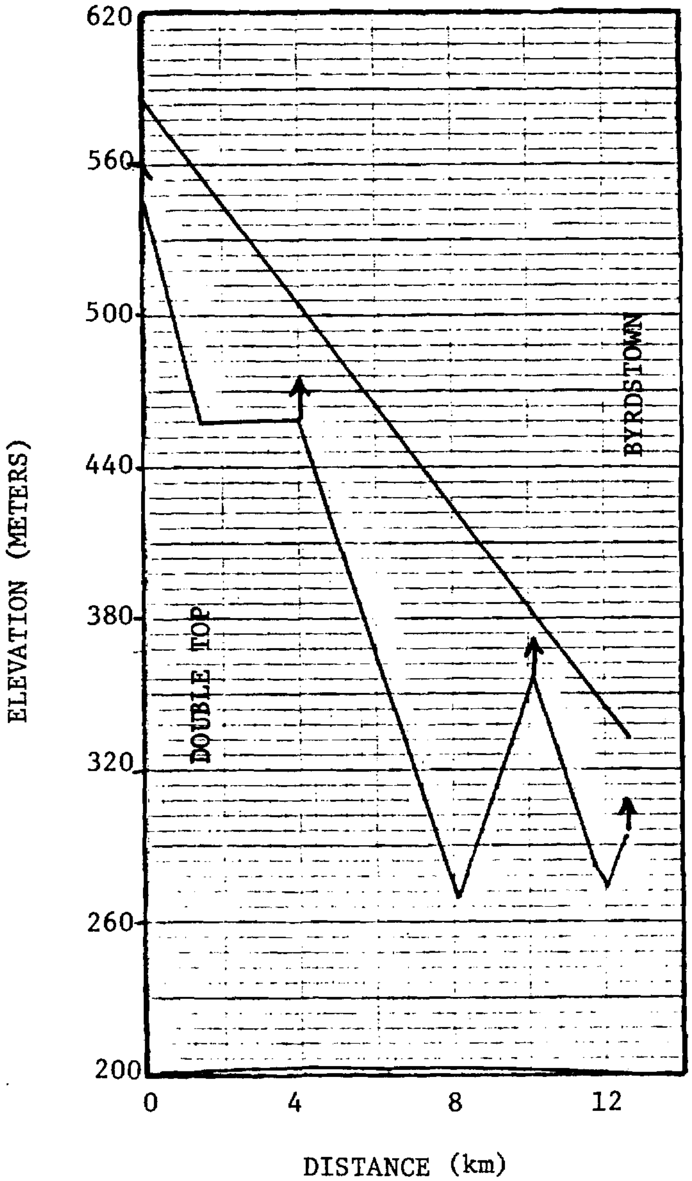


Figure 2-16. Profile for Double Top - Byrdstown path.

TABLE 2-33

ANTENNA SYSTEM CHARACTERISTICS FOR
DOUBLE TOP (15) TO BYRDSTOWN (17) PATH

	SITE	
PARAMETER	DOUBLE TOP (15)	BYRDSTOWN (17)
ANTENNA TYPE	CATEGORY A	CATEGORY A
ANTENNA GAIN (dB)	33	33
CROSS POLARIZATION DISCRIMINATION (dB)	37	37
HEADING (DEGREES)	314.423	134.364
HEIGHT ABOVE GROUND (METERS)	39	39

3. Intra-System Interference Analysis

Most microwave systems consist of a backbone which serves as the long distance trunk for the system and spurs which branch out from the backbone carrying traffic for one or possibly two network nodes. We have subdivided the VEC network in this manner. The network backbone is made up of the following paths:

1 to 2,
2 to 4,
4 to 7,
7 to 9,
9 to 11,
11 to 13, and
13 to 15.

The spur paths are:

2 to 3,
3 to 5,
4 to 6,
7 to 8,
9 to 10,
11 to 12,
13 to 14,
15 to 16, and
15 to 17.

The reason for this distinction, backbone-vs-spur, is tied to the frequency assignment process. Typically, the Federal Communications Commission prefers the so-called two frequency plan for microwave systems. The two frequency plan uses only a single pair of frequencies to implement microwave links between consecutive network nodes and interference rejection is achieved through a combination of the front-to-back ratio associated with the microwave antennas and cross polarization discrimination on consecutive links.

Typically, it is very difficult to have three links terminating on a given node, and achieve the necessary interference rejection with all three links using the same frequency pair. Thus, one commonly assigns the spur paths to an adjacent channel pair (adjacent to the frequency pair used on the backbone.)

Figure 3-1 shows a frequency assignment plan which uses the so-called two frequency plan on the backbone and uses an adjacent channel pair for the spur paths. The path frequency designators have the following meaning.

f1V: transmission on frequency f1 using vertical polarization.

f1H: transmission on frequency f1 using horizontal polarization.

f2V: transmission on frequency f2 using vertical polarization.

f2H: transmission on frequency f2 using horizonal polarization.

f1AH: transmission on a channel adjacent to f1 using horizontal polarization.

f1AV: transmission on a channel adjacent to f1 using vertical polarization.

f2AH: transmission on a channel adjacent to f2 using horizonal polarization.

f2AV: transmision on a channel adjacent to f2 using vertical polarization.

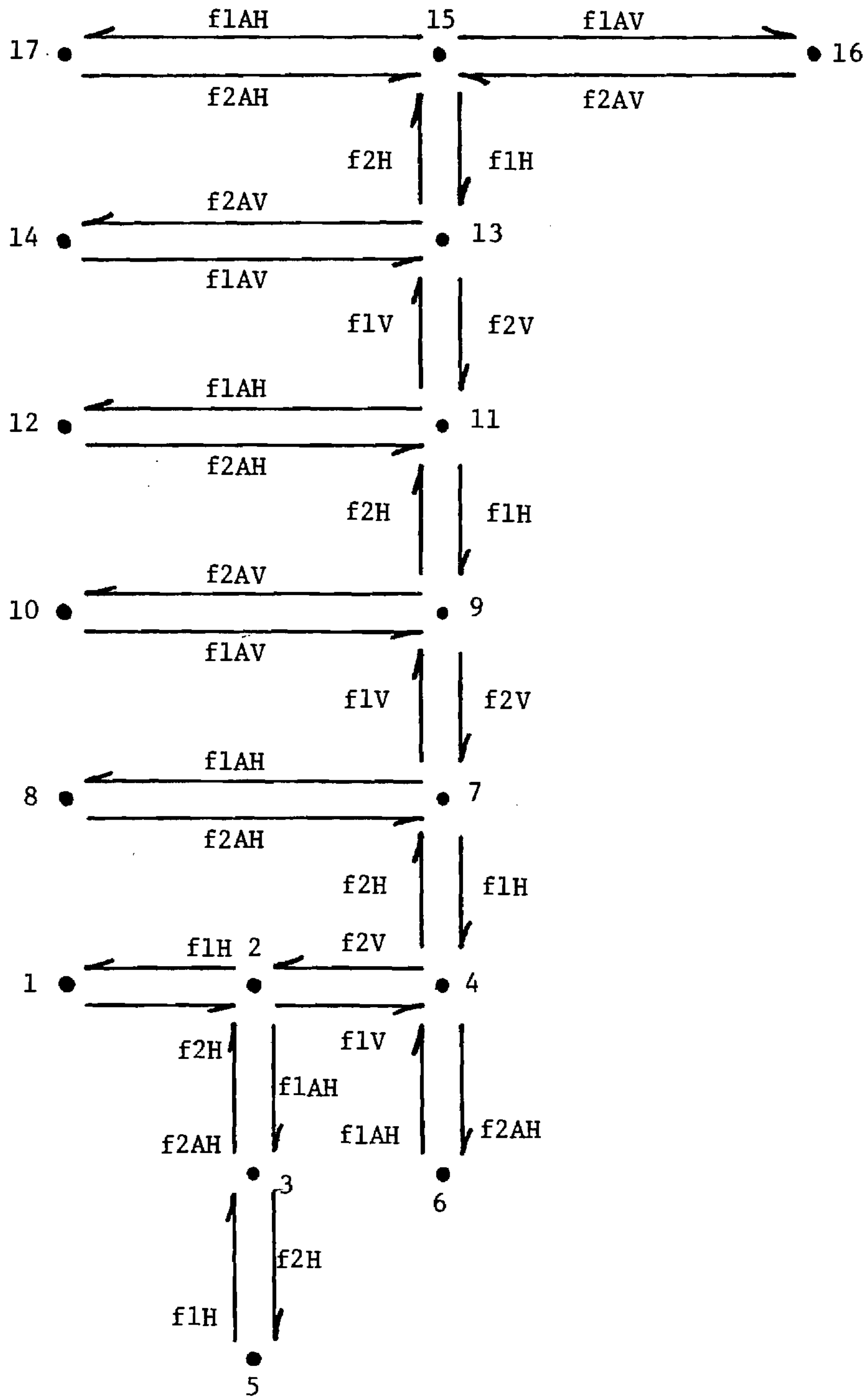


Figure 3-1. Frequency Assignment Plan for VEC microwave system.

The data describing each network node, transmitter power, antenna gain, antenna heading, etc., have been used to evaluate the carrier-to-interference ratio (CIR) as described in Bulletin No. 10-C of the Electronics Industries Association (EIA). The results of that analysis appear in Appendix B. By examining the data Appendix B, one may determine that most of the links in the network have a sufficiently high CIR to function in an acceptable manner as defined by the criteria of EIA Bulletin 10-C. In particular, the interference criteria used in this analysis are shown in Tables 3-1 and 3-2 which are extracted from EIA Bulletin 10-C. Where carrier stability is an influencing factor, it has been assumed that the VEC transmitters are rated at 0.001% frequency stability and are normally maintained within a 0.0005% tolerance.

The cases where the required CIR is not achieved through front-to-back ratios, polarization discrimination, frequency selectivity and spatial separation are identified in Table 3-3. Notice that in most cases where the computed CIR is inadequate by EIA standards a significant amount of terrain blockage is expected from the mountain range that divides VEC's service area into northern and southern segments. The exceptions to this are 4 to 11 and 11 to 4 interference conditions. As currently configured, a direct and unblocked path exists between nodes 4 and 11. Our preliminary evaluations indicates that this can be corrected by a slight shift in the location of node 11.

Two additional points should be mentioned regarding the CIR analysis. The calculated values for CIR assume a cross polarization discrimination of 37 dB when in fact 40 dB is routinely achieved in practice for antennas of the anticipated size. Secondly, the FCC's category A antenna pattern evelope has been assumed in computing the directional response of all antennas. In practice, the actual antenna response routinely is 3 to 10 dB below the envelope value especially on the far-out sidelobes. Collectively these two assumptions mean that our CIR results are quite conservative and that actual interference rejection should be several dB better than the values presented here.

TABLE 3-1

CO-CHANNEL SIDEBAND BEAT CASE, 25 pWpO PER EXPOSURE

	VICTIM CARRIERS					
	UNEMPHASIZED			EMPHASIZED		
INTERFERING CARRIERS	72	48	24	72	48	24
72 Unemph.	61	67	69	61	66	67
48 Unemph.	56	61	65	56	61	63
24 Unemph.	57	63	66	58	64	65
72 Emph.	61	69	69	61	66	67
48 Emph.	56	61	65	56	61	63
24 Emph.	57	63	66	58	64	66

TABLE 3-2

NOMINAL 0.8 MHz FREQUENCY SEPARATION, SIDEBAND BEAT, 25 pWpO PER EXPOSURE, APPLICABLE IF HIGHER THAN THRESHOLD DEGRADATION

VICTIM CARRIERS

INTERFERING CARRIERS	72		48		24	
	0.001%	0.0003%	0.001%	0.0003%	0.001%	0.0003%
72, 0.001%	NOTE (2)		46/42	44/40	41/37	37/36
72, 0.0003%			44/40	45/41	40/36	39/35
48, 0.001%	44/40	43/49	24/20	22/18	11/7	9/5
48, 0.0003%	43/49	42/38	22/18	21/17	9/5	7/3
24, 0.001%	45/41	45/41	22/18	21/17	5/1	3/<0
24, 0.0003%	45/41	44/40	21/17	19/15	3/<0	1/<0

NOTES:

(1) Each objective is shown for unemphasized/emphasized victim systems.

(2) Not applicable to interstitial frequency assignments.

TABLE 3-3

LINKS WITH POTENTIAL INTERFERENCE PROBLEMS

INTERFERENCE SOURCE	VICTIM PATH	CIR (DB)	COMMENT
4 to 7	9 to 11	49.9	NEED TERRAIN BLOCKAGE
4 to 7	13 to 15	51.3	HAVE TERRAIN BLOCKAGE
7 to 9	11 to 13	19.0	HAVE TERRAIN BLOCKAGE
9 to 11	13 to 15	34.0	HAVE TERRAIN BLOCKAGE
11 to 9	7 to 4	52.5	NEED TERRAIN BLOCKAGE
13 to 11	9 to 7	21.6	HAVE TERRAIN BLOCKAGE
15 to 13	7 to 4	50.7	HAVE TERRAIN BLOCKAGE
15 to 13	11 to 9	30.9	HAVE TERRAIN BLOCKAGE

4. Inter-System Interference Analysis

The FCC's Rules and Regulations require that the potential for interference to existing microwave systems be examined as a part of the license application for a new system. In particular, the prospective licensee is required to identify co- and adjacent-channel users within a 125 miles radius and demonstrate, using recognized procedures, that the level of interference caused to the existing systems by the proposed system is "acceptable." Our approach to this has been to use EIA Bulletin 10-C to define acceptable levels of interference based on CIR values. To do this it became necessary to choose actual channel frequencies and evaluate the CIR for the appropriate combination of VEC microwave transmitters and non-VEC microwave receivers. The frequencies chosen for analysis are indicated below.

f1 = 2139.6 MHz
f2 = 2189.6 MHz
f1A = 2130.8 MHz
f2A = 2180.8 MHz

It should be pointed out that the f1 and f2 selections were made because they were expected to be usable and because FCC Rules Permit 1600 kHz transmissions on these channels. This means that the microwave system trunk can be expanded to 72 channels at a later time if that is required.

Table 4-1 identifies the known adjacent channel users for the frequency pair (2138.8 MHz, 2188.8 MHz). Table 4-2 identifies the co-channel known users on the frequency pair (2139.6 MHz, 2189.6 MHz). Table 4-3 identifies the known adjacent channel users on the frequency pair (2140.4 MHz, 2190.4 MHz). Table 4-4 summarizes the technical features associated with each identified node.

The CIRs for all possible combinations of the 17 VEC nodes and the none-VEC nodes identified in Tables 4-1, 2, and 3 have been evaluated, and

TABLE 4-1

USERS OF THE 2138.8 - 2188.8 MHz
FREQUENCY PAIR

		SITE A		SITE B	
STATE	USER'S NAME	LONGITUDE	LATITUDE	LONGITUDE	LATITUDE
GA	GA Power Co.	85/16/20	34/00/28	85/14/06	34/13/58
		Cedartown, GA (#18)		Rome, GA (#19)	
		84/41/46	32/50/47	84/17/25	32/34/16
		Warm Springs, GA		Butler, GA	
		83/23/08	33/51/35	83/28/57	33/33/48
		Watkinsville, GA (#20)		Madison, GA (#21)	
KY	Commonwealth of Kentucky	86/27/33	36/58/55	86/28/37	36/57/02
		Bowling Green, KY (#22)		Bowling Green, KY (#23)	
		84/51/48	38/11/38	84/54/32	38/12/53
		Frankfort, KY (#24)		Frankfort, KY (#25)	
		83/50/07	37/12/53	83/41/30	37/08/50
		Manchester, KY (#26)		Manchester, KY (#27)	
		83/24/18	38/10/38	83/13/13	37/56/31
		Morehead, KY		West Liberty, KY	
		82/31/29	37/17/06	82/13/17	37/30/08
		Pikeville, KY		McVeigh, KY	
NC	Duke Power Company	81/11/38	35/49/24	81/36/30	35/43/22
		Millersville, NC		Drexel, NC	

TABLE 4-2

USERS OF THE 2139.6 - 2189.6 MHz
FREQUENCY PAIR

		SITE A		SITE B	
STATE	USER'S NAME	LONGITUDE	LATITUDE	LONGITUDE	LATITUDE
GA	No. GA EMC	84/56/10 Calhoun, GA (#28)	34/28/50	85/01/10 Dalton, GA (#29)	34/43/60
	GA Power Company	84/20/25 Jasper, GA (#30)	34/31/46	84/38/14 Waleska, GA (#31)	34/19/14

TABLE 4-3

USERS OF THE 2140.4 - 2190.4 MHz
FREQUENCY PAIR

		SITE A		SITE B	
STATE	USER'S NAME	LONGITUDE	LATITUDE	LONGITUDE	LATITUDE
GA	GA Power	84/43/39 Arlington, GA	31/25/48	84/45/07 Cuthbert, GA	31/47/11
		83/17/42 Milledgeville, GA	33/11/31	83/09/24 Eatonton, GA	33/21/01
KY	Commonweath of Kentucky	83/28/43 Bear Branch, KY (#32)	37/08/28	83/35/42 Beverly, KY	36/59/42
		86/38/05 Hadley, KY (#34)	37/05/22	86/36/02 Morgantown, KY (#35)	37/14/02
		83/18/51 Harlan, KY	36/48/56	83/17/28 Harlan, KY	36/47/15
		82/48/07 Waitesburg, KY	37/04/36	82/52/59 Hindman, KY	37/20/29

TABLE 4-4

EXISTING LINK CHARACTERISTICS

POINT NO.	LATITUDE (DEG.)	LONGITUDE (DEG.)	TRANSMITTER POWER (dBm)	ANTENNA GAIN (dB)
18	34.0078	85.2722	30.0	24.9
19	34.2328	85.2350	30.0	24.9
20	33.8597	83.3856	30.0	24.9
21	33.5633	83.4825	30.0	24.9
22	36.9818	86.4592	18.45	24.6
23	36.9506	86.4769	18.45	24.6
24	38.1939	84.8633	18.45	24.6
25	38.2147	84.9089	18.45	24.6
26	37.2147	83.8353	18.45	24.6
27	37.1472	83.6917	18.45	24.6
28	34.4806	84.9361	30.0	25.1
29	34.7333	85.6372	30.0	25.1
30	34.5294	84.3403	30.0	25.1
31	34.3206	84.6372	30.0	25.1
32	37.1411	83.4786	18.45	24.6
33	36.9950	83.5950	18.45	24.6
34	37.0894	86.6347	18.45	24.6
35	37.2339	86.6006	18.45	24.6

the results are presented in Appendix B. Our initial analysis using the techniques of EIA Bulletin 10-C shows that unacceptable interference will result in a limited number of cases, and the cases of concern are identified in Table 4-5. For each case identified in Table 4-5, it will be necessary to demonstrate that sufficient terrain blockage exists between the interference source and victim, or it will be necessary to demonstrate that in light of a detailed knowledge of the victim signal that the calculated CIR is actually sufficient.

Each of the cases presented in Table 4-5 has been examined in detail to see if the required CIRs can be realized in practice. In particular, two issues have been addressed for each combination:

(1) are the interfering signals cross polarized, and

(2) to what extent does the actual terrain along the path between the interference source and the victim receiver cause the propagation loss to exceed the free space loss for points similarly separated?

For this analysis, it has been assumed that the antenna at the victim receiving site can achieve 20 dB of polarization when the interfering signal is cross polarized with respect to the desired signal. This assumption is based on the fact that each of the victim sites employs a parabolic antenna and that even Category B parabolic antennas routinely achieve 31 to 33 dB of cross polarization discrimination. Thus, our cross polarization estimate is conservative by at least 11 dB.

The evaluation of the actual propagation loss for each of the cases shown in Table 4-5 has proceeded along the lines defined by EIA Bulletin 10-C for obstructed interfering paths. In particular, each path has been evaluated for both its median loss (50% of the time) and for its short-term loss (0.01% of the time). The Longley-Rice propagation model defined in National Bureau of Standards Technical Note Number 101 was used for the analysis, and the results are presented in Tables 4-6 through 4-17. Notice

TABLE 4-5

POTENTIAL INTERFERENCE PROBLEMS RELATED
TO THE USE OF THE (2139.6 MHz, 2189.6 MHz) PAIR

INTERFERENCE SOURCE	VICTIM PATH	COMPUTED CIR (dB)	REQUIRED CIR (dB)
11 to 9	30 to 31	66.1	68.0
15 to 13	28 to 29	55.7	68.0
1 to 2	29 to 28	30.7	68.0
9 to 7	31 to 30	50.1	61.0
13 to 11	29 to 28	66.6	68.0

TABLE 4-6

MEDIAN LOSS : RENEGADE--WALESKA,GA

```
        FREQUENCY        2100. MHZ
   ANTENNA HEIGHTS     30.0    30.0 M
 EFFECTIVE HEIGHTS     38.7    38.7 M  (SITING=2,2)
  TERRAIN,DELTA H        436. M

POL=0, EPS=15., SGM= 0.002 S/M
CLIM=5, NO=360., NS=347., K= 1.476

BROADCAST SERVICE
     REQUIRED RELIABILITY- 50.0 PER CENT TIME
                           1.0 PER CENT LOCATIONS
```

ESTIMATED QUANTILES OF BASIC TRANSMISSION LOSS (DB)

DIST KM	FREE SPACE	WITH CONFIDENCE 10.0	50.0	90.0
5.0	112.9	109.1	110.9	120.2
10.0	118.9	115.5	117.8	128.6
15.0	122.4	119.4	123.5	134.6
20.0	124.9	122.3	128.6	139.5
25.0	126.9	124.9	133.2	143.9
30.0	128.4	127.4	137.4	147.9
35.0	129.8	131.0	141.3	151.7
40.0	130.9	134.8	145.1	155.3
45.0	132.0	138.6	148.7	158.7
50.0	132.9	142.1	152.1	162.1
55.0	133.7	145.6	155.4	165.3
60.0	134.5	148.7	158.4	168.2
65.0	135.2	151.7	161.4	171.0
70.0	135.8	154.6	164.2	173.8
75.0	136.4	156.1	165.6	175.1
80.0	137.0	156.8	166.3	175.8
85.0	137.5	157.5	167.0	176.4
90.0	138.0	158.2	167.6	177.0
95.0	138.4	158.9	168.2	177.6
100.0	138.9	159.5	168.8	178.2
105.0	139.3	160.1	169.4	178.7
110.0	139.7	160.7	170.0	179.2
115.0	140.1	161.3	170.5	179.7
120.0	140.5	161.8	171.0	180.2
125.0	140.8	162.3	171.5	180.7
130.0	141.2	162.9	172.0	181.2
135.0	141.5	163.4	172.5	181.7
140.0	141.8	163.9	173.0	182.1
145.0	142.1	164.4	173.5	182.6
150.0	142.4	164.9	174.0	183.1
155.0	142.7	165.4	174.5	183.5
160.0	143.0	165.9	175.0	184.0
165.0	143.2	166.4	175.5	184.5
170.0	143.5	167.0	176.0	185.0
175.0	143.8	167.5	176.5	185.5
180.0	144.0	168.0	177.0	186.0
185.0	144.2	168.6	177.5	186.5
190.0	144.5	169.1	178.1	187.0
195.0	144.7	169.7	178.6	187.5
200.0	144.9	170.2	179.1	188.1

TABLE 4-7

0.01% LOSS : RENEGADE,WALESKA,GA

FREQUENCY	2100. MHZ			
ANTENNA HEIGHTS	30.0	30.0 M		
EFFECTIVE HEIGHTS	38.7	38.7 M	(SITING=2,2)	
TERRAIN,DELTA H	436. M			

POL=0, EPS=15., SGM= 0.002 S/M
CLIM=5, NO=360., NS=347., K= 1.476

BROADCAST SERVICE
REQUIRED RELIABILITY- 0.0 PER CENT TIME
1.0 PER CENT LOCATIONS

ESTIMATED QUANTILES OF BASIC TRANSMISSION LOSS (DB)

DIST KM	FREE SPACE	WITH CONFIDENCE 10.0	50.0	90.0
5.0	112.9	109.1	110.8	119.9
10.0	118.9	115.3	117.4	127.5
15.0	122.4	119.0	121.4	132.1
20.0	124.9	121.6	124.3	135.2
25.0	126.9	123.6	126.5	137.5
30.0	128.4	125.2	128.1	139.2
35.0	129.8	126.4	129.2	140.7
40.0	130.9	127.5	130.1	141.9
45.0	132.0	128.4	130.9	143.0
50.0	132.9	129.1	131.6	144.2
55.0	133.7	129.8	132.2	145.3
60.0	134.5	130.4	132.8	146.3
65.0	135.2	131.0	133.4	147.4
70.0	135.8	131.5	134.0	148.6
75.0	136.4	131.9	134.3	148.7
80.0	137.0	132.3	134.6	148.6
85.0	137.5	132.7	135.0	148.7
90.0	138.0	133.1	135.4	148.9
95.0	138.4	133.5	135.8	149.1
100.0	138.9	133.9	136.2	149.4
105.0	139.3	134.3	136.6	149.8
110.0	139.7	134.7	137.0	150.3
115.0	140.1	135.1	137.4	150.8
120.0	140.5	135.5	137.8	151.3
125.0	140.8	135.9	138.3	151.9
130.0	141.2	136.3	138.7	152.6
135.0	141.5	136.7	139.1	153.2
140.0	141.8	137.1	139.5	154.0
145.0	142.1	137.5	139.9	154.7
150.0	142.4	137.9	140.4	155.5
155.0	142.7	138.3	140.8	156.3
160.0	143.0	138.7	141.3	157.1
165.0	143.2	139.0	141.8	157.9
170.0	143.5	139.4	142.4	158.8
175.0	143.8	139.8	143.1	159.6
180.0	144.0	140.1	144.0	160.4
185.0	144.2	140.5	145.1	161.3
190.0	144.5	140.9	146.1	162.2
195.0	144.7	141.2	147.1	163.0
200.0	144.9	141.5	148.1	163.9

TABLE 4-8

MEDIAN LOSS : DOUBLE TOP -- DALTON,GA

FREQUENCY 2100. MHZ
ANTENNA HEIGHTS 30.0 30.0 M
EFFECTIVE HEIGHTS 38.6 38.6 M (SITING=2,2)
TERRAIN,DELTA H 402. M

POL=0, EPS=15., SGM= 0.002 S/M
CLIM=5, NO=360., NS=344., K= 1.466

BROADCAST SERVICE
REQUIRED RELIABILITY- 50.0 PER CENT TIME
1.0 PER CENT LOCATIONS

ESTIMATED QUANTILES OF BASIC TRANSMISSION LOSS (DB)

DIST	FREE	WITH CONFIDENCE		
KM	SPACE	10.0	50.0	90.0
5.0	112.9	108.8	110.4	117.9
10.0	118.9	115.2	117.0	126.4
15.0	122.4	119.1	121.6	132.4
20.0	124.9	122.0	126.5	137.4
25.0	126.9	124.4	131.2	141.8
30.0	128.4	126.6	135.4	145.9
35.0	129.8	129.2	139.4	149.8
40.0	130.9	133.0	143.2	153.4
45.0	132.0	136.8	146.8	156.9
50.0	132.9	140.4	150.4	160.3
55.0	133.7	143.8	153.7	163.6
60.0	134.5	147.0	156.8	166.5
65.0	135.2	150.1	159.8	169.4
70.0	135.8	153.1	162.7	172.3
75.0	136.4	154.9	164.4	173.9
80.0	137.0	155.6	165.1	174.6
85.0	137.5	156.4	165.8	175.2
90.0	138.0	157.0	166.4	175.8
95.0	138.4	157.7	167.1	176.4
100.0	138.9	158.3	167.7	177.0
105.0	139.3	158.9	168.2	177.5
110.0	139.7	159.5	168.8	178.0
115.0	140.1	160.1	169.3	178.5
120.0	140.5	160.6	169.8	179.0
125.0	140.8	161.2	170.3	179.5
130.0	141.2	161.7	170.8	180.0
135.0	141.5	162.2	171.3	180.5
140.0	141.8	162.7	171.8	181.0
145.0	142.1	163.2	172.3	181.4
150.0	142.4	163.7	172.8	181.9
155.0	142.7	164.3	173.3	182.4
160.0	143.0	164.8	173.8	182.9
165.0	143.2	165.3	174.3	183.3
170.0	143.5	165.8	174.8	183.8
175.0	143.8	166.3	175.3	184.3
180.0	144.0	166.9	175.9	184.8
185.0	144.2	167.4	176.4	185.3
190.0	144.5	168.0	176.9	185.9
195.0	144.7	168.5	177.5	186.4
200.0	144.9	169.1	178.0	186.9

TABLE 4-9

0.01% LOSS : DOUBLE TOP __ DALTON,GA

FREQUENCY	2100. MHZ		
ANTENNA HEIGHTS	30.0	30.0 M	
EFFECTIVE HEIGHTS	38.6	38.6 M	(SITING=2,2)
TERRAIN,DELTA H	402. M		

POL=0, EPS=15., SGM= 0.002 S/M
CLIM=5, NO=360., NS=344., K= 1.466

BROADCAST SERVICE
REQUIRED RELIABILITY- 0.0 PER CENT TIME
1.0 PER CENT LOCATIONS

ESTIMATED QUANTILES OF BASIC TRANSMISSION LOSS (DB)

DIST KM	FREE SPACE	WITH CONFIDENCE 10.0	50.0	90.0
5.0	112.9	108.8	110.4	117.7
10.0	118.9	115.1	116.8	125.3
15.0	122.4	118.8	120.6	129.9
20.0	124.9	121.4	123.3	133.1
25.0	126.9	123.4	125.4	135.5
30.0	128.4	124.9	127.0	137.3
35.0	129.8	126.2	128.3	138.7
40.0	130.9	127.3	129.3	140.0
45.0	132.0	128.1	130.2	141.2
50.0	132.9	128.9	131.0	142.4
55.0	133.7	129.6	131.7	143.6
60.0	134.5	130.2	132.4	144.6
65.0	135.2	130.8	133.0	145.8
70.0	135.8	131.3	133.6	147.1
75.0	136.4	131.8	134.0	147.5
80.0	137.0	132.2	134.4	147.4
85.0	137.5	132.6	134.8	147.5
90.0	138.0	133.0	135.2	147.7
95.0	138.4	133.4	135.6	147.9
100.0	138.9	133.8	136.0	148.3
105.0	139.3	134.2	136.4	148.6
110.0	139.7	134.6	136.8	149.1
115.0	140.1	135.0	137.2	149.6
120.0	140.5	135.4	137.7	150.1
125.0	140.8	135.8	138.1	150.7
130.0	141.2	136.2	138.5	151.4
135.0	141.5	136.6	138.9	152.1
140.0	141.8	137.0	139.3	152.8
145.0	142.1	137.4	139.7	153.5
150.0	142.4	137.8	140.1	154.3
155.0	142.7	138.2	140.6	155.1
160.0	143.0	138.5	141.0	155.9
165.0	143.2	138.9	141.5	156.8
170.0	143.5	139.3	142.0	157.6
175.0	143.8	139.6	142.5	158.4
180.0	144.0	140.0	143.2	159.3
185.0	144.2	140.4	143.9	160.2
190.0	144.5	140.7	144.9	161.0
195.0	144.7	141.1	146.0	161.9
200.0	144.9	141.4	147.0	162.7

TABLE 4-10

MEDIAN LOSS : HAMILTON COUNTY--CALHOUN,GA

FREQUENCY 2100. MHZ
ANTENNA HEIGHTS 30.0 30.0 M
EFFECTIVE HEIGHTS 38.5 38.5 M (SITING=2,2)
TERRAIN,DELTA H 371. M

POL=0, EPS=15., SGM= 0.002 S/M
CLIM=5, NO=360., NS=349., K= 1.487

BROADCAST SERVICE
REQUIRED RELIABILITY- 50.0 PER CENT TIME
1.0 PER CENT LOCATIONS

ESTIMATED QUANTILES OF BASIC TRANSMISSION LOSS (DB)

DIST	FREE	WITH CONFIDENCE		
KM	SPACE	10.0	50.0	90.0
5.0	112.9	108.6	110.1	115.9
10.0	118.9	115.0	116.6	124.4
15.0	122.4	118.8	120.8	130.4
20.0	124.9	121.7	124.6	135.4
25.0	126.9	124.1	129.2	139.9
30.0	128.4	126.2	133.4	144.0
35.0	129.8	128.3	137.5	147.8
40.0	130.9	131.0	141.3	151.5
45.0	132.0	134.8	144.9	155.0
50.0	132.9	138.5	148.4	158.4
55.0	133.7	142.0	151.8	161.7
60.0	134.5	145.1	154.9	164.7
65.0	135.2	148.2	157.9	167.6
70.0	135.8	151.2	160.8	170.4
75.0	136.4	153.7	163.2	172.8
80.0	137.0	154.5	164.0	173.4
85.0	137.5	155.2	164.6	174.1
90.0	138.0	155.9	165.3	174.7
95.0	138.4	156.6	165.9	175.3
100.0	138.9	157.2	166.5	175.8
105.0	139.3	157.8	167.1	176.4
110.0	139.7	158.4	167.6	176.9
115.0	140.1	159.0	168.2	177.4
120.0	140.5	159.5	168.7	177.9
125.0	140.8	160.0	169.2	178.4
130.0	141.2	160.6	169.7	178.9
135.0	141.5	161.1	170.2	179.4
140.0	141.8	161.6	170.7	179.8
145.0	142.1	162.1	171.2	180.3
150.0	142.4	162.6	171.7	180.8
155.0	142.7	163.2	172.2	181.3
160.0	143.0	163.7	172.7	181.8
165.0	143.2	164.2	173.2	182.2
170.0	143.5	164.7	173.7	182.7
175.0	143.8	165.3	174.3	183.2
180.0	144.0	165.8	174.8	183.8
185.0	144.2	166.3	175.3	184.3
190.0	144.5	166.9	175.8	184.8
195.0	144.7	167.4	176.4	185.3
200.0	144.9	168.0	176.9	185.9

TABLE 4-11

0.01% LOSS : HAMILTON COUNTY--CALHOUN,GA

FREQUENCY 2100. MHZ
ANTENNA HEIGHTS 30.0 30.0 M
EFFECTIVE HEIGHTS 38.5 38.5 M (SITING=2,2)
TERRAIN,DELTA H 371. M

POL=0, EPS=15., SGM= 0.002 S/M
CLIM=5, NO=360., NS=349., K= 1.487

BROADCAST SERVICE
REQUIRED RELIABILITY- 0.0 PER CENT TIME
1.0 PER CENT LOCATIONS

ESTIMATED QUANTILES OF BASIC TRANSMISSION LOSS (DB)

DIST KM	FREE SPACE	WITH CONFIDENCE 10.0	50.0	90.0
5.0	112.9	108.6	110.0	115.6
10.0	118.9	114.8	116.4	123.3
15.0	122.4	118.5	120.1	127.9
20.0	124.9	121.1	122.8	131.1
25.0	126.9	123.1	124.8	133.5
30.0	128.4	124.7	126.4	135.3
35.0	129.8	126.0	127.7	136.8
40.0	130.9	127.0	128.8	138.1
45.0	132.0	127.9	129.7	139.3
50.0	132.9	128.7	130.6	140.5
55.0	133.7	129.4	131.3	141.6
60.0	134.5	130.0	132.0	142.7
65.0	135.2	130.6	132.6	143.9
70.0	135.8	131.1	133.2	145.2
75.0	136.4	131.6	133.8	146.3
80.0	137.0	132.0	134.2	146.2
85.0	137.5	132.5	134.6	146.3
90.0	138.0	132.9	135.0	146.5
95.0	138.4	133.3	135.5	146.8
100.0	138.9	133.7	135.9	147.1
105.0	139.3	134.1	136.3	147.5
110.0	139.7	134.5	136.7	147.9
115.0	140.1	134.9	137.1	148.5
120.0	140.5	135.3	137.5	149.0
125.0	140.8	135.7	137.9	149.6
130.0	141.2	136.1	138.3	150.3
135.0	141.5	136.5	138.7	151.0
140.0	141.8	136.9	139.1	151.7
145.0	142.1	137.3	139.5	152.4
150.0	142.4	137.7	139.9	153.2
155.0	142.7	138.0	140.3	154.0
160.0	143.0	138.4	140.8	154.8
165.0	143.2	138.8	141.2	155.7
170.0	143.5	139.2	141.6	156.5
175.0	143.8	139.5	142.1	157.4
180.0	144.0	139.9	142.7	158.2
185.0	144.2	140.2	143.3	159.1
190.0	144.5	140.6	144.0	159.9
195.0	144.7	140.9	144.9	160.8
200.0	144.9	141.3	145.9	161.7

TABLE 4-12

MEDIAN LOSS : GRANDVIEW--JASPER,GA

```
           FREQUENCY         2100. MHZ
     ANTENNA HEIGHTS      30.0      30.0 M
   EFFECTIVE HEIGHTS      38.9      38.9 M    (SITING=2,2)
    TERRAIN,DELTA H          512. M

POL=1, EPS=15., SGM= 0.002 S/M
CLIM=5, NO=360., NS=348., K= 1.481

BROADCAST SERVICE
     REQUIRED RELIABILITY- 50.0 PER CENT TIME
                            1.0 PER CENT LOCATIONS
```

ESTIMATED QUANTILES OF BASIC TRANSMISSION LOSS (DB)

DIST	FREE	WITH CONFIDENCE		
KM	SPACE	10.0	50.0	90.0
5.0	112.9	109.7	113.5	125.0
10.0	118.9	116.2	122.1	133.4
15.0	122.4	120.2	128.1	139.2
20.0	124.9	123.4	133.2	144.1
25.0	126.9	127.0	137.7	148.3
30.0	128.4	131.2	141.8	152.3
35.0	129.8	135.2	145.6	156.0
40.0	130.9	139.0	149.2	159.5
45.0	132.0	142.6	152.7	162.8
50.0	132.9	146.1	156.1	166.1
55.0	133.7	149.5	159.3	169.2
60.0	134.5	152.5	162.2	172.0
65.0	135.2	155.4	165.1	174.8
70.0	135.8	158.3	167.9	177.5
75.0	136.4	159.4	169.0	178.5
80.0	137.0	160.2	169.6	179.1
85.0	137.5	160.9	170.3	179.8
90.0	138.0	161.6	171.0	180.4
95.0	138.4	162.2	171.6	181.0
100.0	138.9	162.9	172.2	181.5
105.0	139.3	163.4	172.7	182.0
110.0	139.7	164.0	173.3	182.6
115.0	140.1	164.6	173.8	183.1
120.0	140.5	165.1	174.3	183.5
125.0	140.8	165.7	174.8	184.0
130.0	141.2	166.2	175.3	184.5
135.0	141.5	166.7	175.8	185.0
140.0	141.8	167.2	176.3	185.4
145.0	142.1	167.7	176.8	185.9
150.0	142.4	168.2	177.3	186.4
155.0	142.7	168.7	177.8	186.8
160.0	143.0	169.2	178.3	187.3
165.0	143.2	169.7	178.8	187.8
170.0	143.5	170.2	179.3	188.3
175.0	143.8	170.8	179.8	188.8
180.0	144.0	171.3	180.3	189.3
185.0	144.2	171.8	180.8	189.8
190.0	144.5	172.4	181.3	190.3
195.0	144.7	172.9	181.9	190.8
200.0	144.9	173.5	182.4	191.3

0-STOP

TABLE 4-13

0.01% LOSS : GRANDVIEW--JASPER,GA

```
        FREQUENCY        2100. MHZ
  ANTENNA HEIGHTS     30.0     30.0 M
EFFECTIVE HEIGHTS     38.9     38.9 M   (SITING=2,2)
  TERRAIN,DELTA H        512. M

POL=1, EPS=15., SGM= 0.002 S/M
CLIM=5, NO=360., NS=348., K= 1.481

BROADCAST SERVICE
     REQUIRED RELIABILITY-  0.0 PER CENT TIME
                            1.0 PER CENT LOCATIONS
```

ESTIMATED QUANTILES OF BASIC TRANSMISSION LOSS (DB)

DIST	FREE	WITH CONFIDENCE		
KM	SPACE	10.0	50.0	90.0
5.0	112.9	109.7	113.2	124.8
10.0	118.9	116.0	120.9	132.2
15.0	122.4	119.7	125.6	136.7
20.0	124.9	122.3	128.8	139.8
25.0	126.9	124.3	130.9	142.0
30.0	128.4	125.9	132.4	143.6
35.0	129.8	127.1	133.4	145.0
40.0	130.9	128.1	134.1	146.1
45.0	132.0	128.9	134.5	147.2
50.0	132.9	129.7	134.9	148.2
55.0	133.7	130.3	135.1	149.2
60.0	134.5	130.9	135.2	150.1
65.0	135.2	131.4	135.4	151.1
70.0	135.8	131.9	135.9	152.3
75.0	136.4	132.3	135.4	152.1
80.0	137.0	132.7	135.5	151.9
85.0	137.5	133.1	135.8	152.1
90.0	138.0	133.5	136.1	152.2
95.0	138.4	133.9	136.5	152.5
100.0	138.9	134.3	136.9	152.8
105.0	139.3	134.7	137.3	153.2
110.0	139.7	135.1	137.7	153.6
115.0	140.1	135.5	138.1	154.1
120.0	140.5	135.9	138.5	154.6
125.0	140.8	136.3	138.9	155.2
130.0	141.2	136.7	139.4	155.9
135.0	141.5	137.1	139.9	156.5
140.0	141.8	137.5	140.4	157.3
145.0	142.1	137.9	140.9	158.0
150.0	142.4	138.3	141.5	158.8
155.0	142.7	138.7	142.2	159.6
160.0	143.0	139.0	143.2	160.4
165.0	143.2	139.4	144.2	161.2
170.0	143.5	139.8	145.2	162.0
175.0	143.8	140.2	146.2	162.9
180.0	144.0	140.5	147.3	163.7
185.0	144.2	140.9	148.3	164.6
190.0	144.5	141.3	149.3	165.4
195.0	144.7	141.6	150.4	166.3
200.0	144.9	142.0	151.4	167.1

**WARNING - SOME PARAMETERS ARE NEARLY OUT OF RANGE.

TABLE 4-14

MEDIAN LOSS : ISOLINE--CALHOUN,GA

FREQUENCY	2100. MHZ		
ANTENNA HEIGHTS	30.0	30.0 M	
EFFECTIVE HEIGHTS	38.7	38.7 M	(SITING=2,2)
TERRAIN,DELTA H	414. M		

POL=1, EPS=15., SGM= 0.002 S/M
CLIM=5, NO=360., NS=340., K= 1.451

BROADCAST SERVICE
REQUIRED RELIABILITY- 50.0 PER CENT TIME
1.0 PER CENT LOCATIONS

ESTIMATED QUANTILES OF BASIC TRANSMISSION LOSS (DB)

DIST	FREE	WITH CONFIDENCE		
KM	SPACE	10.0	50.0	90.0
5.0	112.9	108.9	110.6	118.7
10.0	118.9	115.3	117.3	127.2
15.0	122.4	119.2	122.2	133.2
20.0	124.9	122.1	127.3	138.2
25.0	126.9	124.6	132.0	142.6
30.0	128.4	126.9	136.2	146.7
35.0	129.8	129.8	140.2	150.6
40.0	130.9	133.8	144.0	154.2
45.0	132.0	137.6	147.6	157.7
50.0	132.9	141.2	151.2	161.1
55.0	133.7	144.6	154.5	164.4
60.0	134.5	147.8	157.6	167.3
65.0	135.2	150.9	160.5	170.2
70.0	135.8	153.9	163.5	173.0
75.0	136.4	155.6	165.1	174.6
80.0	137.0	156.3	165.8	175.3
85.0	137.5	157.0	166.5	175.9
90.0	138.0	157.7	167.1	176.5
95.0	138.4	158.4	167.7	177.1
100.0	138.9	159.0	168.3	177.7
105.0	139.3	159.6	168.9	178.2
110.0	139.7	160.2	169.5	178.7
115.0	140.1	160.7	170.0	179.2
120.0	140.5	161.3	170.5	179.7
125.0	140.8	161.8	171.0	180.2
130.0	141.2	162.4	171.5	180.7
135.0	141.5	162.9	172.0	181.1
140.0	141.8	163.4	172.5	181.6
145.0	142.1	163.9	173.0	182.1
150.0	142.4	164.4	173.5	182.6
155.0	142.7	164.9	174.0	183.0
160.0	143.0	165.4	174.5	183.5
165.0	143.2	165.9	175.0	184.0
170.0	143.5	166.5	175.5	184.5
175.0	143.8	167.0	176.0	185.0
180.0	144.0	167.5	176.5	185.5
185.0	144.2	168.1	177.0	186.0
190.0	144.5	168.6	177.6	186.5
195.0	144.7	169.2	178.1	187.0
200.0	144.9	169.7	178.6	187.6

TABLE 4-15

0.01% LOSS : ISOLINE--CALHOUN,GA

FREQUENCY 2100. MHZ
ANTENNA HEIGHTS 30.0 30.0 M
EFFECTIVE HEIGHTS 38.7 38.7 M (SITING=2,2)
TERRAIN,DELTA H 414. M

POL=1, EPS=15., SGM= 0.002 S/M
CLIM=5, NO=360., NS=340., K= 1.451

BROADCAST SERVICE
REQUIRED RELIABILITY- 0.0 PER CENT TIME
1.0 PER CENT LOCATIONS

ESTIMATED QUANTILES OF BASIC TRANSMISSION LOSS (DB)

DIST KM	FREE SPACE	WITH CONFIDENCE 10.0	50.0	90.0
5.0	112.9	108.9	110.5	118.5
10.0	118.9	115.2	117.0	126.1
15.0	122.4	118.9	120.9	130.7
20.0	124.9	121.5	123.6	133.9
25.0	126.9	123.5	125.8	136.3
30.0	128.4	125.0	127.4	138.1
35.0	129.8	126.3	128.6	139.5
40.0	130.9	127.4	129.6	140.8
45.0	132.0	128.2	130.5	142.0
50.0	132.9	129.0	131.2	143.2
55.0	133.7	129.7	131.9	144.3
60.0	134.5	130.3	132.5	145.4
65.0	135.2	130.9	133.2	146.6
70.0	135.8	131.4	133.8	147.9
75.0	136.4	131.8	134.2	148.1
80.0	137.0	132.2	134.5	148.1
85.0	137.5	132.7	134.9	148.2
90.0	138.0	133.1	135.3	148.4
95.0	138.4	133.5	135.7	148.6
100.0	138.9	133.9	136.1	148.9
105.0	139.3	134.3	136.5	149.3
110.0	139.7	134.7	136.9	149.8
115.0	140.1	135.1	137.4	150.3
120.0	140.5	135.5	137.8	150.8
125.0	140.8	135.9	138.2	151.4
130.0	141.2	136.3	138.6	152.1
135.0	141.5	136.7	139.0	152.7
140.0	141.8	137.1	139.4	153.5
145.0	142.1	137.5	139.8	154.2
150.0	142.4	137.8	140.3	155.0
155.0	142.7	138.2	140.7	155.8
160.0	143.0	138.6	141.2	156.6
165.0	143.2	139.0	141.7	157.4
170.0	143.5	139.4	142.2	158.3
175.0	143.8	139.7	142.8	159.1
180.0	144.0	140.1	143.6	159.9
185.0	144.2	140.4	144.6	160.8
190.0	144.5	140.8	145.6	161.7
195.0	144.7	141.1	146.6	162.5
200.0	144.9	141.5	147.6	163.4

that for each path the attenuation has been evaluated for three confidence levels - 10%, 50%, and 90%. The results summarized in Table 4-16 use the attenuation values associated with the 50% confidence level.

On reviewing the results presented in Table 4-16, one finds that all of the required CIR objectives are met with the exception of the short-term objective for the case where Grandview (#9) interferes with Jasper, Ga. (#30). The deficiency in the CIR in this case is 2.3 dB. If a higher confidence level is used for the excess path loss calculation then no deficiency will appear. For example, Table 4-13 shows an excess path loss of 15.5 dB for a confidence level of 90%. Using this value for the excess path loss produces a short-term CIR of 65.6 dB which exceeds both the median (61.0) and short-term (51.0) required CIR. On this basis, it is argued that the interference caused by Grandview (#9) To Jasper, GA (#30) will be in the acceptable range.

A similar investigation has been conducted for the (2130.8 MHz, 2180.8 MHz) frequency pair and its adjacent channel pair. Tables 4-17 and 4-18 identify the co- and adjacent-channel users, and the technical characteristics are presented in Table 4-19.

The results of the analysis of the extent of interference cause by the proposed VEC stations to the existing stations identified in Tables 4-17 and 4-18 are presented in Appendix C. A review of these results indicates that there are possible interference problems, and Tables 4-20 identifies the case of interest.

The median and short-term propagation losses for the Isoline (#13) to Nashville (#34) path are presented in Tables 4-20 and 4-21 respectively, and the effective CIRs are presented in Table 4-22. Notice that both the median and short-term CIR objectives are met, and therefore no unacceptable external interference is anticipated.

TABLE 4-16

DETAILED CIR ANALYSIS RESULTS
FOR SELECTED TRUNK PATHS

INTER-FERENCE SOURCE	VICTIM PATH	BASIC CIR (dB)	CROSS-POLARIZATION ATTEN. (dB)	EXCESS TERRAIN LOSS (dB)	EFFECTIVE CIR (dB)	REQUIRED CIR (dB)
11 to 9	30 to 31	66.1	20	32.7(M)*	118.8(M)*	68.0
				-0.7(ST)**	85.4(ST)**	58.0
15 to 13	28 to 29	55.7	20	32.8(M)	108.5(M)	68.0
				1.3 (ST)	77.0(ST)	58.0
1 to 2	29 to 28	30.7	20	27(M)	77.7(M)	68.0
				-2.8(ST)	47.9(ST)	58.0
9 to 7	31 to 30	50.1	0	34.5(M)	84.6(M)	61.0
				-1.4(ST)	48.7(ST)	51.0
13 to 11	29 to 28	66.6	0	33.1(M)	99.7(M)	68.0
				1.1(ST)	65.5(ST)	58.0

*M: Median Value

**ST: Short Term Value

TABLE 4-17

USERS OF THE 2130.8 - 2180.8 MHz
FREQUENCY PAIR

		SITE A		SITE B	
STATE	USER'S NAME	LONGITUDE	LATITUDE	LONGITUDE	LATITUDE
AL	So. Georgia Natural Gas Company	85/00/04 Holy Trinity, AL	32/12/37	84/06/49 Albany, GA	31/30/08
GA	So. Georgia Natural Gas Company	84/44/24 Arlington, GA	31/27/14	84/41/53 Brooklyn, GA	32/11/15
	Ga. Power	83/37/35 Macon, GA	32/49/16	83/42/01 Macon, GA	32/55/32
KY	Commonwealth of Kentucky	83/18/14 Harlan, KY (#18)	36/54/03	83/17/28 Harlan, KY (#19)	36/47/15
		83/02/03 Iron Hill, KY (#20)	38/22/59	82/59/22 Pineville, KY (#21)	38/11/32
	Kentucky Utilities Co.	83/41/45 Pineville, KY (#22)	36/45/40	82/59/22 Pineville, KY (23)	38/11/32

TABLE 4-18

USERS OF THE 2131.6 - 2181.6 MHz
FREQUENCY PAIR

		SITE A		SITE B	
STATE	USER'S NAME	LONGITUDE	LATITUDE	LONGITUDE	LATITUDE
GA	GA Power Co.	81/33/31 Brunswick, GA	31/16/48	81/44/45 White Oak, GA	31/02/48
		83/51/28 Gainsville, GA (#24)	34/16/46	83/46/41 Cleveland, GA (#25)	34/33/57
		83/09/33 Lexington, GA (#26)	33/48/20	83/66/57 Corner, GA (#27)	34/03/58
	No. GA EMC	85/11/46 Lafayette, GA (#28)	34/41/06	85/18/30 Summerville, GA (#29)	34/31/29
	L&N Railroad Company	84/42/47 Oakman, GA (#30)	34/38/38	84/50/13 Chatsworth, GA (#31)	34/46/54
		84/23/13 Tate, GA (#32)	34/24/52	84/38/10 Waleska, GA (#33)	34/19/19
NC	Va. Elect. Power Co.	76/59/03 Ahoskie, NC	36/16/59	77/04/47 Aulander, NC	36/15/22
	Duke Power	81/05/21 Denver, NC	35/34/04	82/36/30 Drexel, NC	35/43/22
TN	City of Jackson	Jackson, TN		Jackson, TN	
	City of Nashville	86/40/20 Nashville, TN (#34)	36/06/19	86/58/01 Nashville, TN (#35)	36/06/37
	Gibson Co. EMC	Tiptonville, TN		Rutherford, TN	
		Union City, TN		Troy, TN	

TABLE 4-19

EXISTING LINK CHARACTERISTICS
(2130.8 and 2131.6 MHz)

POINT NO.	LATITUDE (DEG.)	LONGITUDE (DEG.)	TRANSMITTER POWER (dBm)	ANTENNA GAIN (dB)
18	36.9008	83.3039	18.45	24.6
19	36.7875	83.2911	18.45	24.6
20	38.3831	83.0342	30.0	24.6
21	38.1922	82.9894	30.0	24.6
22	36.7611	83.6958	30.0	24.2
23	36.1922	82.9894	30.0	24.2
24	34.2794	83.8578	30.4	25.1
25	34.5658	83.7781	30.4	25.1
26	33.8056	83.1592	30.4	25.1
27	34.0661	83.1158	30.4	25.1
28	34.6850	85.1961	30.4	25.1
29	34.5247	85.3083	30.4	25.1
30	34.6439	84.7131	31.8	24.7
31	34.7817	84.8369	31.8	24.7

TABLE 4-20

POTENTIAL INTERFERENCE PROBLEMS RELATED
TO THE USE OF THE (2130.8 MHz, 2180.8 MHz) PAIR

INTERFERENCE SOURCE	VICTIM PATH	COMPUTED CIR (dB)	REQUIRED CIR (dB)
13 to 14	35 to 34	44.3	49.0

TABLE 4-21

MEDIAN LOSS : ISOLINE--NASHVILLE,TN

```
          FREQUENCY        2100. MHZ
    ANTENNA HEIGHTS     30.0     30.0 M
  EFFECTIVE HEIGHTS     38.6     38.6 M  (SITING=2,2)
   TERRAIN,DELTA H         386. M

POL=1, EPS=15., SGM= 0.002 S/M
CLIM=5, NO=360., NS=341., K= 1.454

BROADCAST SERVICE
     REQUIRED RELIABILITY- 50.0 PER CENT TIME
                            1.0 PER CENT LOCATIONS

ESTIMATED QUANTILES OF BASIC TRANSMISSION LOSS (DB)
```

DIST KM	FREE SPACE	WITH CONFIDENCE 10.0	50.0	90.0
5.0	112.9	108.7	110.2	116.9
10.0	118.9	115.1	116.8	125.4
15.0	122.4	119.0	121.1	131.4
20.0	124.9	121.9	125.6	136.5
25.0	126.9	124.3	130.2	140.9
30.0	128.4	126.4	134.5	145.0
35.0	129.8	128.7	138.6	148.9
40.0	130.9	132.2	142.4	152.6
45.0	132.0	136.0	146.1	156.1
50.0	132.9	139.6	149.6	159.6
55.0	133.7	143.1	153.0	162.8
60.0	134.5	146.3	156.1	165.8
65.0	135.2	149.4	159.1	168.7
70.0	135.8	152.4	162.0	171.6
75.0	136.4	155.1	164.6	174.1
80.0	137.0	155.8	165.3	174.8
85.0	137.5	156.6	166.0	175.4
90.0	138.0	157.3	166.7	176.0
95.0	138.4	157.9	167.3	176.6
100.0	138.9	158.5	167.9	177.2
105.0	139.3	159.1	168.4	177.7
110.0	139.7	159.7	169.0	178.3
115.0	140.1	160.3	169.5	178.8
120.0	140.5	160.8	170.1	179.3
125.0	140.8	161.4	170.6	179.7
130.0	141.2	161.9	171.1	180.2
135.0	141.5	162.4	171.6	180.7
140.0	141.8	162.9	172.1	181.2
145.0	142.1	163.5	172.5	181.6
150.0	142.4	164.0	173.0	182.1
155.0	142.7	164.5	173.5	182.6
160.0	143.0	165.0	174.0	183.1
165.0	143.2	165.5	174.5	183.6
170.0	143.5	166.0	175.0	184.0
175.0	143.8	166.6	175.6	184.5
180.0	144.0	167.1	176.1	185.1
185.0	144.2	167.6	176.6	185.6
190.0	144.5	168.2	177.1	186.1
195.0	144.7	168.7	177.7	186.6
200.0	144.9	169.3	178.2	187.1

TABLE 4-22

0.01% LOSS : ISOLINE--NASHVILLE,TN

FREQUENCY 2100. MHZ
ANTENNA HEIGHTS 30.0 30.0 M
EFFECTIVE HEIGHTS 38.6 38.6 M (SITING=2,2)
TERRAIN,DELTA H 386. M

POL=1, EPS=15., SGM= 0.002 S/M
CLIM=5, NO=360., NS=341., K= 1.454

BROADCAST SERVICE
REQUIRED RELIABILITY- 0.0 PER CENT TIME
1.0 PER CENT LOCATIONS

ESTIMATED QUANTILES OF BASIC TRANSMISSION LOSS (DB)

DIST KM	FREE SPACE	WITH CONFIDENCE 10.0	50.0	90.0
5.0	112.9	108.7	110.2	116.6
10.0	118.9	114.9	116.6	124.3
15.0	122.4	118.6	120.4	129.0
20.0	124.9	121.3	123.1	132.2
25.0	126.9	123.2	125.1	134.6
30.0	128.4	124.8	126.7	136.4
35.0	129.8	126.1	128.0	137.9
40.0	130.9	127.2	129.1	139.2
45.0	132.0	128.1	130.0	140.4
50.0	132.9	128.8	130.8	141.6
55.0	133.7	129.5	131.5	142.8
60.0	134.5	130.1	132.2	143.9
65.0	135.2	130.7	132.8	145.1
70.0	135.8	131.3	133.5	146.4
75.0	136.4	131.8	134.1	147.7
80.0	137.0	132.2	134.4	147.6
85.0	137.5	132.6	134.8	147.7
90.0	138.0	133.0	135.3	147.9
95.0	138.4	133.4	135.7	148.2
100.0	138.9	133.8	136.1	148.5
105.0	139.3	134.2	136.5	148.9
110.0	139.7	134.6	136.9	149.3
115.0	140.1	135.0	137.3	149.8
120.0	140.5	135.4	137.7	150.3
125.0	140.8	135.8	138.1	151.0
130.0	141.2	136.2	138.5	151.6
135.0	141.5	136.6	138.9	152.3
140.0	141.8	137.0	139.3	153.0
145.0	142.1	137.4	139.7	153.8
150.0	142.4	137.8	140.2	154.5
155.0	142.7	138.2	140.6	155.3
160.0	143.0	138.6	141.1	156.2
165.0	143.2	138.9	141.5	157.0
170.0	143.5	139.3	142.0	157.8
175.0	143.8	139.7	142.6	158.7
180.0	144.0	140.0	143.3	159.5
185.0	144.2	140.4	144.1	160.4
190.0	144.5	140.7	145.2	161.2
195.0	144.7	141.1	146.2	162.1
200.0	144.9	141.4	147.2	162.9

TABLE 4-23

DETAILED CIR ANALYSIS RESULTS
FOR SELECTED TRUNK PATHS

INTER-FERENCE SOURCE	VICTIM PATH	BASIC CIR (dB)	CROSS-POLARIZATION ATTEN. (dB)	EXCESS TERRAIN LOSS (dB)	EFFECTIVE CIR (dB)	REQUIRED CIR (dB)
13 to 14	35 to 34	44.3	0	30.4(M)*	74.7(M)*	49.0
				-2.4(ST)**	41.9	39.0

*M: Median Value

**ST: Short Term Value

5. Summary of Results

The analyses described in Sections 3 and 4 have been performed in an iterative fashion to achieve suitable levels of inter- and intra-system interference. Adjustments have been made to transmitter power levels and antenna gains to achieve the desired results. The pertinent technical characteristics may be found in the calculated results appearing in Appendices B and C; however, to facilitate the license application process, the pertinent technical parameters for each link are summarized in Table 5-1.

TABLE 5-1
SUMMARY OF LINK CHARACTERISTICS

					ANTENNA SYSTEM				
LINK	NO. OF CHAN.	EMPHASIS	FREQ. (MHz)	TRANS. OUTPUT (dBm)	CATEGORY	GAIN (dB)	POLAR-IZATION	BEARING (DEGREES)	ELEV. ABOVE GROUND (METERS)
1 to 2	24	NO	2139.6	12.4	A	33	HORIZ.	174.3	6
2 to 1	24	NO	2189.6	12.4	A	33	HORIZ.	354.3	15
2 to 3	24	NO	2130.8	8.8	A	33	HORIZ.	58.2	15
2 to 4	24	NO	2139.6	21.7	A	33	VERT.	83.4	15
3 to 2	24	NO	2180.8	8.8	A	33	HORIZ.	238.3	15
3 to 5	24	YES	2189.6	-20.2	A	33	HORIZ.	120.1	6
4 to 2	24	NO	2189.6	21.7	A	33	VERT.	263.7	15
4 to 6	24	NO	2180.8	9.5	A	33	HORIZ.	253.1	15
4 to 7	24	NO	2189.6	21.4	A	33	HORIZ.	331.1	15
5 to 3	24	NO	2139.6	-20.2	A	33	HORIZ.	300.2	15
6 to 4	24	NO	2130.8	9.5	A	33	HORIZ.	73.1	12
7 to 4	24	NO	2139.6	21.4	A	33	HORIZ	151.0	15
7 to 8	48	YES	2130.8	8.1	A	33	HORIZ.	270.0	17
7 to 9	48	NO	2139.6	16.9	A	33	VERT.	344.6	12
8 to 7	48	NO	2180.8	-6.9	A	33	HORIZ.	90.0	12
9 to 7	48	YES	2189.6	16.9	A	33	VERT.	164.6	15
9 to 10	24	NO	2180.8	5.8	A	33	VERT.	192.6	15
9 to 11	48	YES	2189.6	8.8	A	33	HORIZ.	357.6	18
10 to 9	24	NO	2130.8	0.8	A	33	VERT.	12.6	15
11 to 9	48	YES	2139.6	8.8	A	33	HORIZ.	177.6	15
11 to 12	24	NO	2130.8	8.1	A	33	HORIZ.	293.6	35
11 to 13	24	NO	2139.6	18.3	A	33	VERT.	326.1	33
12 to 11	24	NO	2180.8	8.1	A	33	HORIZ.	113.5	18
13 to 11	24	NO	2189.6	18.3	A	33	VERT.	146.0	21
13 to 14	24	NO	2180.8	10.7	A	33	VERT.	282.9	69
13 to 15	24	NO	2189.6	21.9	A	33	HORIZ.	1.0	45
14 to 13	24	NO	2130.8	10.7	A	33	VERT.	102.8	63
15 to 13	24	NO	2139.6	21.9	A	33	HORIZ.	181.0	39
15 to 16	24	NO	2130.8	0.3	A	33	VERT.	128.8	39
15 to 17	24	NO	2130.8	1.1	A	33	HORIZ.	314.4	39
16 to 15	24	NO	2180.8	0.3	A	33	VERT.	308.8	39
17 to 15	24	NO	2180.8	1.1	A	33	HORIZ.	134.4	39

APPENDIX A

To actually implement a microwave it is necessary to know among other things:

(1) the location of the transmitting site,

(2) the location of the receiving site,

(3) the distance between the transmitting and receiving sites,

(4) the required heading of the transmitting antenna, and

(5) the propagation loss between the transmitter and receiver.

The results presented in this section define each of these quantities for the proposed nodes in the VEC network. A column-by-column description of the data items follows.

COLUMN 1: The number designation associated with the starting point of a microwave path. This number corresponds to the node definitions in Table 2-1.

COLUMN 2: The latitude in degrees north for the starting point of the microwave path.

COLUMN 3: The longitude in degrees west for the starting point of the microwave path.

COLUMN 4: The number designation associated with the end point of a microwave path. This number corresponds to the node definitions in Table 2-1.

COLUMN 5: The latitude in degrees north for the end point of the microwave path.

COLUMN 6: The longitude in degrees west for the end point of the microwave path.

COLUMN 7: The distance in statute miles between the starting and ending points of the path.

COLUMN 8: The required heading angle in degrees east of north for the antenna looking from the starting point to the ending point.

COLUMN 9: The free-space attenuation in dB at the proposed operating frequency between the starting and ending points.

RUN NAVIG
INPUT FROM TTY (0) OR FILE (1)?
1

PT	LAT(S) DEGREES	LON(S) DEGREES	PT	LAT(F) DEGREES	LON(F) DEGREES	DISTANCE S. MILES	HEADING DEGREES	A DB
1	35.215	85.031	2	35.149	85.023	4.546	174.260	116.4
1	35.215	85.031	3	35.231	84.863	9.549	83.497	122.8
1	35.215	85.031	4	35.193	84.559	26.685	93.199	131.8
1	35.215	85.031	5	35.215	84.830	11.337	90.000	124.3
1	35.215	85.031	6	35.168	84.657	21.346	98.620	129.8
1	35.215	85.031	7	35.518	84.779	25.240	34.140	131.3
1	35.215	85.031	8	35.518	84.789	24.920	33.044	131.2
1	35.215	85.031	9	35.730	84.851	36.965	15.828	134.6
1	35.215	85.031	10	35.688	84.863	33.966	16.126	133.9
1	35.215	85.031	11	35.885	84.859	47.227	11.744	136.7
1	35.215	85.031	12	35.942	85.020	50.144	0.727	137.3
1	35.215	85.031	13	36.100	85.039	61.066	359.622	139.0
1	35.215	85.031	14	36.143	85.271	65.408	348.230	139.6
1	35.215	85.031	15	36.491	85.030	88.071	0.050	142.1
1	35.215	85.031	16	36.427	84.931	83.814	3.830	141.7
1	35.215	85.031	17	36.570	85.130	93.677	356.646	142.7
1	35.215	85.031	18	36.982	86.459	145.600	327.277	146.5
1	35.215	85.031	19	36.951	86.477	144.351	326.478	146.4
1	35.215	85.031	20	37.215	83.835	153.204	25.410	147.0
1	35.215	85.031	21	37.147	83.692	152.777	28.840	146.9
1	35.215	85.031	22	34.481	84.936	50.963	173.896	137.4
1	35.215	85.031	23	34.733	85.019	33.242	178.832	133.7
1	35.215	85.031	24	34.529	84.340	61.386	140.209	139.0
1	35.215	85.031	25	34.321	84.637	65.636	159.987	139.6
1	35.215	85.031	26	37.141	83.479	158.557	32.598	147.3
1	35.215	85.031	27	36.995	83.595	146.613	32.682	146.6
1	35.215	85.031	28	37.089	86.635	157.180	325.839	147.2
1	35.215	85.031	29	37.234	86.601	164.415	328.373	147.6
1	35.215	85.031	30	36.816	83.314	146.220	40.450	146.6
1	35.215	85.031	31	36.788	83.291	145.630	41.330	146.5
2	35.149	85.023	1	35.215	85.031	4.546	354.265	116.4
2	35.149	85.023	3	35.231	84.863	10.630	58.186	123.8
2	35.149	85.023	4	35.193	84.559	26.364	83.396	131.7
2	35.149	85.023	5	35.215	84.830	11.790	67.383	124.7
2	35.149	85.023	6	35.168	84.657	20.693	86.336	129.6
2	35.149	85.023	7	35.518	84.779	28.876	28.351	132.5
2	35.149	85.023	8	35.518	84.789	28.606	27.335	132.4
2	35.149	85.023	9	35.730	84.851	41.227	13.510	135.6
2	35.149	85.023	10	35.688	84.863	38.223	13.592	134.9
2	35.149	85.023	11	35.885	84.859	51.581	10.231	137.5
2	35.149	85.023	12	35.942	85.020	54.664	0.195	138.0
2	35.149	85.023	13	36.100	85.039	65.594	359.256	139.6
2	35.149	85.023	14	36.143	85.271	69.931	348.626	140.1
2	35.149	85.023	15	36.491	85.030	92.595	359.771	142.6
2	35.149	85.023	16	36.427	84.931	88.300	3.344	142.2
2	35.149	85.023	17	36.570	85.130	98.220	356.540	143.1
2	35.149	85.023	18	36.982	86.459	149.665	328.071	146.8
2	35.149	85.023	19	36.951	86.477	148.389	327.300	146.7
2	35.149	85.023	20	37.215	83.835	157.112	24.557	147.2
2	35.149	85.023	21	37.147	83.692	156.542	27.901	147.1
2	35.149	85.023	22	34.481	84.936	46.417	173.865	136.6
2	35.149	85.023	23	34.733	85.019	28.713	179.560	132.4
2	35.149	85.023	24	34.529	84.340	57.675	137.684	138.5
2	35.149	85.023	25	34.321	84.637	61.240	158.943	139.0
2	35.149	85.023	26	37.141	83.479	162.147	31.606	147.4
2	35.149	85.023	27	36.995	83.595	150.201	31.610	146.8
2	35.149	85.023	28	37.089	86.635	161.193	326.612	147.4

2	35.149	85.023	29	37.234	86.601	168.516	329.052	147.8
2	35.149	85.023	30	36.816	83.314	149.403	39.197	146.7
2	35.149	85.023	31	36.788	83.291	148.764	40.053	146.7
3	35.231	84.863	1	35.215	85.031	9.549	263.595	122.8
3	35.231	84.863	2	35.149	85.023	10.630	238.278	123.8
3	35.231	84.863	4	35.193	84.559	17.347	98.619	128.0
3	35.231	84.863	5	35.215	84.830	2.137	120.145	109.8
3	35.231	84.863	6	35.168	84.657	12.381	110.325	125.1
3	35.231	84.863	7	35.518	84.779	20.354	13.384	129.4
3	35.231	84.863	8	35.518	84.789	20.228	11.793	129.4
3	35.231	84.863	9	35.730	84.851	34.487	1.086	134.0
3	35.231	84.863	10	35.688	84.863	31.548	0.000	133.2
3	35.231	84.863	11	35.885	84.859	45.157	0.256	136.3
3	35.231	84.863	12	35.942	85.020	49.851	349.870	137.2
3	35.231	84.863	13	36.100	85.039	60.793	350.735	138.9
3	35.231	84.863	14	36.143	85.271	66.963	340.164	139.8
3	35.231	84.863	15	36.491	85.030	87.497	353.924	142.1
3	35.231	84.863	16	36.427	84.931	82.637	357.401	141.6
3	35.231	84.863	17	36.570	85.130	93.639	350.900	142.7
3	35.231	84.863	18	36.982	86.459	150.063	324.103	146.8
3	35.231	84.863	19	36.951	86.477	148.932	323.302	146.7
3	35.231	84.863	20	37.215	83.835	148.377	22.377	146.7
3	35.231	84.863	21	37.147	83.692	147.459	25.911	146.6
3	35.231	84.863	22	34.481	84.936	51.915	184.591	137.6
3	35.231	84.863	23	34.733	85.019	35.429	194.496	134.2
3	35.231	84.863	24	34.529	84.340	56.709	148.397	138.3
3	35.231	84.863	25	34.321	84.637	64.081	168.414	139.4
3	35.231	84.863	26	37.141	83.479	152.714	29.915	146.9
3	35.231	84.863	27	36.995	83.595	140.774	29.767	146.2
3	35.231	84.863	28	37.089	86.635	161.834	322.941	147.4
3	35.231	84.863	29	37.234	86.601	168.691	325.534	147.8
3	35.231	84.863	30	36.816	83.314	139.394	37.868	146.1
3	35.231	84.863	31	36.788	83.291	138.700	38.780	146.1
4	35.193	84.559	1	35.215	85.031	26.685	273.471	131.8
4	35.193	84.559	2	35.149	85.023	26.364	263.664	131.7
4	35.193	84.559	3	35.231	84.863	17.347	278.794	128.0
4	35.193	84.559	5	35.215	84.830	15.380	275.872	127.0
4	35.193	84.559	6	35.168	84.657	5.796	253.112	118.5
4	35.193	84.559	7	35.518	84.779	25.623	331.131	131.4
4	35.193	84.559	8	35.518	84.789	25.908	330.014	131.5
4	35.193	84.559	9	35.730	84.851	40.585	336.191	135.4
4	35.193	84.559	10	35.688	84.863	38.213	333.507	134.9
4	35.193	84.559	11	35.885	84.859	50.675	340.636	137.3
4	35.193	84.559	12	35.942	85.020	57.809	333.538	138.5
4	35.193	84.559	13	36.100	85.039	68.150	336.892	139.9
4	35.193	84.559	14	36.143	85.271	76.759	328.880	141.0
4	35.193	84.559	15	36.491	85.030	93.417	343.753	142.7
4	35.193	84.559	16	36.427	84.931	87.679	346.387	142.1
4	35.193	84.559	17	36.570	85.130	100.289	341.594	143.3
4	35.193	84.559	18	36.982	86.459	162.696	319.921	147.5
4	35.193	84.559	19	36.951	86.477	161.727	319.154	147.4
4	35.193	84.559	20	37.215	83.835	145.232	15.893	146.5
4	35.193	84.559	21	37.147	83.692	143.263	19.450	146.4
4	35.193	84.559	22	34.481	84.936	53.568	203.612	137.8
4	35.193	84.559	23	34.733	85.019	41.012	219.552	135.5
4	35.193	84.559	24	34.529	84.340	47.395	164.799	136.8
4	35.193	84.559	25	34.321	84.637	60.328	184.244	138.9
4	35.193	84.559	26	37.141	83.479	147.303	23.794	146.6
4	35.193	84.559	27	36.995	83.595	135.485	23.087	145.9
4	35.193	84.559	28	37.089	86.635	174.665	319.140	148.1
4	35.193	84.559	29	37.234	86.601	180.984	321.698	148.4
4	35.193	84.559	30	36.816	83.314	131.789	31.452	145.6
4	35.193	84.559	31	36.788	83.291	130.847	32.375	145.6
5	35.215	84.830	1	35.215	85.031	11.337	270.000	124.3
5	35.215	84.830	2	35.149	85.023	11.790	247.494	124.7
5	35.215	84.830	3	35.231	84.863	2.137	300.164	109.8

5	35.215	84.830	4	35.193	84.559	15.380	95.715	127.0
5	35.215	84.830	6	35.168	84.657	10.282	108.313	123.5
5	35.215	84.830	7	35.518	84.779	21.070	7.830	129.7
5	35.215	84.830	8	35.518	84.789	20.999	6.270	129.7
5	35.215	84.830	9	35.730	84.851	35.574	358.095	134.3
5	35.215	84.830	10	35.688	84.863	32.674	356.777	133.5
5	35.215	84.830	11	35.885	84.859	46.259	357.980	136.6
5	35.215	84.830	12	35.942	85.020	51.258	348.067	137.4
5	35.215	84.830	13	36.100	85.039	62.172	349.232	139.1
5	35.215	84.830	14	36.143	85.271	68.614	339.036	140.0
5	35.215	84.830	15	36.491	85.030	88.776	352.830	142.2
5	35.215	84.830	16	36.427	84.931	83.812	356.191	141.7
5	35.215	84.830	17	36.570	85.130	95.006	349.921	142.8
5	35.215	84.830	18	36.982	86.459	152.019	323.796	146.9
5	35.215	84.830	19	36.951	86.477	150.899	323.002	146.8
5	35.215	84.830	20	37.215	83.835	148.681	21.580	146.7
5	35.215	84.830	21	37.147	83.692	147.632	25.103	146.6
5	35.215	84.830	22	34.481	84.936	51.030	186.775	137.4
5	35.215	84.830	23	34.733	85.019	34.914	197.893	134.1
5	35.215	84.830	24	34.529	84.340	54.836	149.472	138.0
5	35.215	84.830	25	34.321	84.637	62.679	169.890	139.2
5	35.215	84.830	26	37.141	83.479	152.738	29.133	146.9
5	35.215	84.830	27	36.995	83.595	140.805	28.917	146.2
5	35.215	84.830	28	37.089	86.635	163.806	322.671	147.5
5	35.215	84.830	29	37.234	86.601	170.624	325.245	147.9
5	35.215	84.830	30	36.816	83.314	139.123	37.016	146.1
5	35.215	84.830	31	36.788	83.291	138.396	37.924	146.1
6	35.168	84.657	1	35.215	85.031	21.346	278.836	129.8
6	35.168	84.657	2	35.149	85.023	20.693	266.547	129.6
6	35.168	84.657	3	35.231	84.863	12.381	290.444	125.1
6	35.168	84.657	4	35.193	84.559	5.796	73.055	118.5
6	35.168	84.657	5	35.215	84.830	10.282	288.413	123.5
6	35.168	84.657	7	35.518	84.779	25.069	344.146	131.2
6	35.168	84.657	8	35.518	84.789	25.234	342.886	131.3
6	35.168	84.657	9	35.730	84.851	40.299	344.343	135.4
6	35.168	84.657	10	35.688	84.863	37.682	342.174	134.8
6	35.168	84.657	11	35.885	84.859	50.756	347.130	137.4
6	35.168	84.657	12	35.942	85.020	57.132	339.223	138.4
6	35.168	84.657	13	36.100	85.039	67.768	341.713	139.9
6	35.168	84.657	14	36.143	85.271	75.543	333.088	140.8
6	35.168	84.657	15	36.491	85.030	93.661	347.244	142.7
6	35.168	84.657	16	36.427	84.931	88.200	350.092	142.2
6	35.168	84.657	17	36.570	85.130	100.303	344.848	143.3
6	35.168	84.657	18	36.982	86.459	160.502	321.765	147.4
6	35.168	84.657	19	36.951	86.477	159.461	321.000	147.3
6	35.168	84.657	20	37.215	83.835	148.450	17.717	146.7
6	35.168	84.657	21	37.147	83.692	146.772	21.216	146.6
6	35.168	84.657	22	34.481	84.936	49.999	198.498	137.2
6	35.168	84.657	23	34.733	85.019	36.324	214.435	134.5
6	35.168	84.657	24	34.529	84.340	47.579	157.748	136.8
6	35.168	84.657	25	34.321	84.637	58.488	178.863	138.6
6	35.168	84.657	26	37.141	83.479	151.145	25.403	146.8
6	35.168	84.657	27	36.995	83.595	139.280	24.857	146.1
6	35.168	84.657	28	37.089	86.635	172.391	320.843	148.0
6	35.168	84.657	29	37.234	86.601	178.949	323.368	148.3
6	35.168	84.657	30	36.816	83.314	136.174	33.016	145.9
6	35.168	84.657	31	36.788	83.291	135.292	33.920	145.9
7	35.518	84.779	1	35.215	85.031	25.240	214.266	131.3
7	35.518	84.779	2	35.149	85.023	28.876	208.492	132.5
7	35.518	84.779	3	35.231	84.863	20.354	193.432	129.4
7	35.518	84.779	4	35.193	84.559	25.623	151.003	131.4
7	35.518	84.779	5	35.215	84.830	21.070	187.860	129.7
7	35.518	84.779	6	35.168	84.657	25.069	164.075	131.2
7	35.518	84.779	8	35.518	84.789	0.577	270.000	98.5
7	35.518	84.779	9	35.730	84.851	15.230	344.597	126.9
7	35.518	84.779	10	35.688	84.863	12.657	338.195	125.3

7	35.518	84.779	11	35.885	84.859	25.753	349.964	131.5
7	35.518	84.779	12	35.942	85.020	32.227	335.325	133.4
7	35.518	84.779	13	36.100	85.039	42.734	340.216	135.9
7	35.518	84.779	14	36.143	85.271	51.166	327.626	137.4
7	35.518	84.779	15	36.491	85.030	68.641	348.304	140.0
7	35.518	84.779	16	36.427	84.931	63.318	352.372	139.3
7	35.518	84.779	17	36.570	85.130	75.236	345.011	140.8
7	35.518	84.779	18	36.982	86.459	137.652	317.720	146.0
7	35.518	84.779	19	36.951	86.477	136.765	316.799	146.0
7	35.518	84.779	20	37.215	83.835	128.313	23.846	145.4
7	35.518	84.779	21	37.147	83.692	127.666	27.940	145.4
7	35.518	84.779	22	34.481	84.936	72.097	187.113	140.4
7	35.518	84.779	23	34.733	85.019	55.781	194.138	138.2
7	35.518	84.779	24	34.529	84.340	72.546	159.884	140.5
7	35.518	84.779	25	34.321	84.637	82.979	174.405	141.6
7	35.518	84.779	26	37.141	83.479	133.327	32.452	145.7
7	35.518	84.779	27	36.995	83.595	121.383	32.526	144.9
7	35.518	84.779	28	37.089	86.635	149.695	316.976	146.8
7	35.518	84.779	29	37.234	86.601	155.764	320.026	147.1
7	35.518	84.779	30	36.816	83.314	121.164	41.908	144.9
7	35.518	84.779	31	36.788	83.291	120.630	42.976	144.9
8	35.518	84.789	1	35.215	85.031	24.920	213.184	131.2
8	35.518	84.789	2	35.149	85.023	28.606	207.470	132.4
8	35.518	84.789	3	35.231	84.863	20.228	191.836	129.4
8	35.518	84.789	4	35.193	84.559	25.908	149.881	131.5
8	35.518	84.789	5	35.215	84.830	20.999	186.294	129.7
8	35.518	84.789	6	35.168	84.657	25.234	162.809	131.3
8	35.518	84.789	7	35.518	84.779	0.577	90.000	98.5
8	35.518	84.789	9	35.730	84.851	15.087	346.704	126.8
8	35.518	84.789	10	35.688	84.863	12.454	340.655	125.2
8	35.518	84.789	11	35.885	84.859	25.659	351.228	131.4
8	35.518	84.789	12	35.942	85.020	31.990	336.258	133.4
8	35.518	84.789	13	36.100	85.039	42.542	340.941	135.8
8	35.518	84.789	14	36.143	85.271	50.859	328.169	137.4
8	35.518	84.789	15	36.491	85.030	68.527	348.771	140.0
8	35.518	84.789	16	36.427	84.931	63.244	352.884	139.3
8	35.518	84.789	17	36.570	85.130	75.089	345.431	140.8
8	35.518	84.789	18	36.982	86.459	137.264	317.893	146.0
8	35.518	84.789	19	36.951	86.477	136.370	316.970	145.9
8	35.518	84.789	20	37.215	83.835	128.547	24.075	145.4
8	35.518	84.789	21	37.147	83.692	127.938	28.163	145.4
8	35.518	84.789	22	34.481	84.936	72.028	186.651	140.4
8	35.518	84.789	23	34.733	85.019	55.643	193.556	138.2
8	35.518	84.789	24	34.529	84.340	72.747	159.452	140.5
8	35.518	84.789	25	34.321	84.637	83.037	174.003	141.6
8	35.518	84.789	26	37.141	83.479	133.638	32.655	145.8
8	35.518	84.789	27	36.995	83.595	121.694	32.749	145.0
8	35.518	84.789	28	37.089	86.635	149.302	317.132	146.7
8	35.518	84.789	29	37.234	86.601	155.394	320.183	147.1
8	35.518	84.789	30	36.816	83.314	121.551	42.104	144.9
8	35.518	84.789	31	36.788	83.291	121.024	43.170	144.9
9	35.730	84.851	1	35.215	85.031	36.965	195.933	134.6
9	35.730	84.851	2	35.149	85.023	41.227	193.609	135.6
9	35.730	84.851	3	35.231	84.863	34.487	181.093	134.0
9	35.730	84.851	4	35.193	84.559	40.585	156.021	135.4
9	35.730	84.851	5	35.215	84.830	35.574	178.083	134.3
9	35.730	84.851	6	35.168	84.657	40.299	164.230	135.4
9	35.730	84.851	7	35.518	84.779	15.230	164.555	126.9
9	35.730	84.851	8	35.518	84.789	15.087	166.668	126.8
9	35.730	84.851	10	35.688	84.863	3.004	192.570	112.8
9	35.730	84.851	11	35.885	84.859	10.685	357.585	123.8
9	35.730	84.851	12	35.942	85.020	17.370	327.161	128.0
9	35.730	84.851	13	36.100	85.039	27.573	337.756	132.1
9	35.730	84.851	14	36.143	85.271	36.868	320.658	134.6
9	35.730	84.851	15	36.491	85.030	53.452	349.317	137.8
9	35.730	84.851	16	36.427	84.931	48.272	354.776	136.9

9	35.730	84.851	17	36.570	85.130	60.007	345.075	138.8
9	35.730	84.851	18	36.982	86.459	124.258	314.503	145.1
9	35.730	84.851	19	36.951	86.477	123.497	313.461	145.1
9	35.730	84.851	20	37.215	83.835	116.916	28.529	144.6
9	35.730	84.851	21	37.147	83.692	117.058	33.020	144.6
9	35.730	84.851	22	34.481	84.936	86.363	183.199	142.0
9	35.730	84.851	23	34.733	85.019	69.438	187.888	140.1
9	35.730	84.851	24	34.529	84.340	87.734	160.659	142.1
9	35.730	84.851	25	34.321	84.637	98.021	172.847	143.1
9	35.730	84.851	26	37.141	83.479	123.624	37.649	145.1
9	35.730	84.851	27	36.995	83.595	111.751	38.288	144.2
9	35.730	84.851	28	37.089	86.635	136.384	313.967	145.9
9	35.730	84.851	29	37.234	86.601	142.054	317.430	146.3
9	35.730	84.851	30	36.816	83.314	113.664	48.339	144.4
9	35.730	84.851	31	36.788	83.291	113.388	49.500	144.3
10	35.688	84.863	1	35.215	85.031	33.966	196.223	133.9
10	35.688	84.863	2	35.149	85.023	38.223	193.684	134.9
10	35.688	84.863	3	35.231	84.863	31.548	180.000	133.2
10	35.688	84.863	4	35.193	84.559	38.213	153.331	134.9
10	35.688	84.863	5	35.215	84.830	32.674	176.758	133.5
10	35.688	84.863	6	35.168	84.657	37.682	162.055	134.8
10	35.688	84.863	7	35.518	84.779	12.657	158.146	125.3
10	35.688	84.863	8	35.518	84.789	12.454	160.612	125.2
10	35.688	84.863	9	35.730	84.851	3.004	12.563	112.8
10	35.688	84.863	11	35.885	84.859	13.610	0.850	125.9
10	35.688	84.863	12	35.942	85.020	19.596	333.422	129.1
10	35.688	84.863	13	36.100	85.039	30.088	341.017	132.8
10	35.688	84.863	14	36.143	85.271	38.793	324.146	135.0
10	35.688	84.863	15	36.491	85.030	56.225	350.519	138.2
10	35.688	84.863	16	36.427	84.931	51.141	355.798	137.4
10	35.688	84.863	17	36.570	85.130	62.687	346.336	139.2
10	35.688	84.863	18	36.982	86.459	125.873	315.657	145.2
10	35.688	84.863	19	36.951	86.477	125.066	314.636	145.2
10	35.688	84.863	20	37.215	83.835	119.808	28.128	144.8
10	35.688	84.863	21	37.147	83.692	119.877	32.512	144.8
10	35.688	84.863	22	34.481	84.936	83.400	182.856	141.7
10	35.688	84.863	23	34.733	85.019	66.444	187.670	139.7
10	35.688	84.863	24	34.529	84.340	85.198	159.585	141.9
10	35.688	84.863	25	34.321	84.637	95.198	172.230	142.8
10	35.688	84.863	26	37.141	83.479	126.352	37.065	145.3
10	35.688	84.863	27	36.995	83.595	114.465	37.629	144.4
10	35.688	84.863	28	37.089	86.635	137.973	315.025	146.0
10	35.688	84.863	29	37.234	86.601	143.792	318.405	146.4
10	35.688	84.863	30	36.816	83.314	116.115	47.465	144.5
10	35.688	84.863	31	36.788	83.291	115.804	48.600	144.5
11	35.885	84.859	1	35.215	85.031	47.227	191.844	136.7
11	35.885	84.859	2	35.149	85.023	51.581	190.327	137.5
11	35.885	84.859	3	35.231	84.863	45.157	180.258	136.3
11	35.885	84.859	4	35.193	84.559	50.675	160.461	137.3
11	35.885	84.859	5	35.215	84.830	46.259	177.963	136.6
11	35.885	84.859	6	35.168	84.657	50.756	167.013	137.4
11	35.885	84.859	7	35.518	84.779	25.753	169.918	131.5
11	35.885	84.859	8	35.518	84.789	25.659	171.187	131.4
11	35.885	84.859	9	35.730	84.851	10.685	177.580	123.8
11	35.885	84.859	10	35.688	84.863	13.610	180.852	125.9
11	35.885	84.859	12	35.942	85.020	9.787	293.594	123.1
11	35.885	84.859	13	36.100	85.039	17.892	326.063	128.3
11	35.885	84.859	14	36.143	85.271	29.044	307.884	132.5
11	35.885	84.859	15	36.491	85.030	42.905	347.261	135.9
11	35.885	84.859	16	36.427	84.931	37.603	353.973	134.8
11	35.885	84.859	17	36.570	85.130	49.629	342.397	137.2
11	35.885	84.859	18	36.982	86.459	116.682	310.913	144.6
11	35.885	84.859	19	36.951	86.477	116.065	309.783	144.5
11	35.885	84.859	20	37.215	83.835	107.892	31.443	143.9
11	35.885	84.859	21	37.147	83.692	108.528	36.287	144.0
11	35.885	84.859	22	34.481	84.936	97.003	182.577	143.0

11	35.885	84.859	23	34.733	85.019	79.974	186.514	141.3
11	35.885	84.859	24	34.529	84.340	98.006	162.473	143.1
11	35.885	84.859	25	34.321	84.637	108.673	173.307	144.0
11	35.885	84.859	26	37.141	83.479	115.651	41.052	144.5
11	35.885	84.859	27	36.995	83.595	103.884	42.129	143.6
11	35.885	84.859	28	37.089	86.635	128.859	310.685	145.5
11	35.885	84.859	29	37.234	86.601	134.064	314.481	145.8
11	35.885	84.859	30	36.816	83.314	107.223	52.759	143.9
11	35.885	84.859	31	36.788	83.291	107.128	53.997	143.8
12	35.942	85.020	1	35.215	85.031	50.144	180.734	137.3
12	35.942	85.020	2	35.149	85.023	54.664	180.197	138.0
12	35.942	85.020	3	35.231	84.863	49.851	169.779	137.2
12	35.942	85.020	4	35.193	84.559	57.809	153.270	138.5
12	35.942	85.020	5	35.215	84.830	51.258	167.956	137.4
12	35.942	85.020	6	35.168	84.657	57.132	159.012	138.4
12	35.942	85.020	7	35.518	84.779	32.227	155.184	133.4
12	35.942	85.020	8	35.518	84.789	31.990	156.123	133.4
12	35.942	85.020	9	35.730	84.851	17.370	147.062	128.0
12	35.942	85.020	10	35.688	84.863	19.596	153.331	129.1
12	35.942	85.020	11	35.885	84.859	9.787	113.500	123.1
12	35.942	85.020	13	36.100	85.039	10.974	354.575	124.1
12	35.942	85.020	14	36.143	85.271	19.708	314.831	129.1
12	35.942	85.020	15	36.491	85.030	37.935	359.162	134.8
12	35.942	85.020	16	36.427	84.931	33.853	8.435	133.8
12	35.942	85.020	17	36.570	85.130	43.806	351.981	136.1
12	35.942	85.020	18	36.982	86.459	107.378	312.374	143.9
12	35.942	85.020	19	36.951	86.477	106.700	311.154	143.8
12	35.942	85.020	20	37.215	83.835	109.658	36.420	144.1
12	35.942	85.020	21	37.147	83.692	111.090	41.122	144.2
12	35.942	85.020	22	34.481	84.936	100.928	177.290	143.3
12	35.942	85.020	23	34.733	85.019	83.375	179.978	141.7
12	35.942	85.020	24	34.529	84.340	104.702	158.342	143.6
12	35.942	85.020	25	34.321	84.637	113.923	168.960	144.4
12	35.942	85.020	26	37.141	83.479	118.955	45.459	144.8
12	35.942	85.020	27	36.995	83.595	107.397	46.990	143.9
12	35.942	85.020	28	37.089	86.635	119.538	311.969	144.8
12	35.942	85.020	29	37.234	86.601	124.969	315.986	145.2
12	35.942	85.020	30	36.816	83.314	112.318	57.028	144.3
12	35.942	85.020	31	36.788	83.291	112.399	58.209	144.3
13	36.100	85.039	1	35.215	85.031	61.066	179.618	139.0
13	36.100	85.039	2	35.149	85.023	65.594	179.247	139.6
13	36.100	85.039	3	35.231	84.863	60.793	170.633	138.9
13	36.100	85.039	4	35.193	84.559	68.150	156.613	139.9
13	36.100	85.039	5	35.215	84.830	62.172	169.111	139.1
13	36.100	85.039	6	35.168	84.657	67.768	161.491	139.9
13	36.100	85.039	7	35.518	84.779	42.734	160.064	135.9
13	36.100	85.039	8	35.518	84.789	42.542	160.795	135.8
13	36.100	85.039	9	35.730	84.851	27.573	157.646	132.1
13	36.100	85.039	10	35.688	84.863	30.088	160.914	132.8
13	36.100	85.039	11	35.885	84.859	17.892	145.958	128.3
13	36.100	85.039	12	35.942	85.020	10.974	174.564	124.1
13	36.100	85.039	14	36.143	85.271	13.275	282.915	125.7
13	36.100	85.039	15	36.491	85.030	27.010	1.013	131.9
13	36.100	85.039	16	36.427	84.931	23.346	14.890	130.6
13	36.100	85.039	17	36.570	85.130	32.847	351.103	133.6
13	36.100	85.039	18	36.982	86.459	99.521	308.116	143.2
13	36.100	85.039	19	36.951	86.477	99.017	306.775	143.2
13	36.100	85.039	20	37.215	83.835	101.746	40.534	143.4
13	36.100	85.039	21	37.147	83.692	103.848	45.510	143.6
13	36.100	85.039	22	34.481	84.936	111.891	177.013	144.2
13	36.100	85.039	23	34.733	85.019	94.306	179.340	142.7
13	36.100	85.039	24	34.529	84.340	115.280	159.855	144.5
13	36.100	85.039	25	34.321	84.637	124.849	169.441	145.2
13	36.100	85.039	26	37.141	83.479	112.354	49.793	144.3
13	36.100	85.039	27	36.995	83.595	101.078	51.914	143.3
13	36.100	85.039	28	37.089	86.635	111.708	308.146	144.2

13	36.100	85.039	29	37.234	86.601	116.592	312.610	144.6
13	36.100	85.039	30	36.816	83.314	107.683	62.200	143.9
13	36.100	85.039	31	36.788	83.291	107.973	63.421	143.9
14	36.143	85.271	1	35.215	85.031	65.408	168.090	139.6
14	36.143	85.271	2	35.149	85.023	69.931	168.481	140.1
14	36.143	85.271	3	35.231	84.863	66.963	159.926	139.8
14	36.143	85.271	4	35.193	84.559	76.759	148.465	141.0
14	36.143	85.271	5	35.215	84.830	68.614	158.779	140.0
14	36.143	85.271	6	35.168	84.657	75.543	152.730	140.8
14	36.143	85.271	7	35.518	84.779	51.166	147.338	137.4
14	36.143	85.271	8	35.518	84.789	50.859	147.887	137.4
14	36.143	85.271	9	35.730	84.851	36.868	140.412	134.6
14	36.143	85.271	10	35.688	84.863	38.793	143.907	135.0
14	36.143	85.271	11	35.885	84.859	29.044	127.642	132.5
14	36.143	85.271	12	35.942	85.020	19.708	134.684	129.1
14	36.143	85.271	13	36.100	85.039	13.275	102.778	125.7
14	36.143	85.271	15	36.491	85.030	27.530	29.031	132.0
14	36.143	85.271	16	36.427	84.931	27.252	43.887	132.0
14	36.143	85.271	17	36.570	85.130	30.514	14.789	132.9
14	36.143	85.271	18	36.982	86.459	87.692	311.674	142.1
14	36.143	85.271	19	36.951	86.477	87.042	310.174	142.0
14	36.143	85.271	20	37.215	83.835	108.540	46.618	144.0
14	36.143	85.271	21	37.147	83.692	111.562	51.125	144.2
14	36.143	85.271	22	34.481	84.936	116.231	170.571	144.6
14	36.143	85.271	23	34.733	85.019	98.273	171.659	143.1
14	36.143	85.271	24	34.529	84.340	123.026	154.531	145.0
14	36.143	85.271	25	34.321	84.637	130.705	163.961	145.6
14	36.143	85.271	26	37.141	83.479	120.788	54.698	144.9
14	36.143	85.271	27	36.995	83.595	109.918	57.161	144.1
14	36.143	85.271	28	37.089	86.635	99.860	311.257	143.2
14	36.143	85.271	29	37.234	86.601	105.265	316.054	143.7
14	36.143	85.271	30	36.816	83.314	118.064	66.268	144.7
14	36.143	85.271	31	36.788	83.291	118.519	67.369	144.7
15	36.491	85.030	1	35.215	85.031	88.071	180.051	142.1
15	36.491	85.030	2	35.149	85.023	92.595	179.767	142.6
15	36.491	85.030	3	35.231	84.863	87.497	173.826	142.1
15	36.491	85.030	4	35.193	84.559	93.417	163.477	142.7
15	36.491	85.030	5	35.215	84.830	88.776	172.713	142.2
15	36.491	85.030	6	35.168	84.657	93.661	167.026	142.7
15	36.491	85.030	7	35.518	84.779	68.641	168.157	140.0
15	36.491	85.030	8	35.518	84.789	68.527	168.629	140.0
15	36.491	85.030	9	35.730	84.851	53.452	169.212	137.8
15	36.491	85.030	10	35.688	84.863	56.225	170.421	138.2
15	36.491	85.030	11	35.885	84.859	42.905	167.160	135.9
15	36.491	85.030	12	35.942	85.020	37.935	179.156	134.8
15	36.491	85.030	13	36.100	85.039	27.010	181.018	131.9
15	36.491	85.030	14	36.143	85.271	27.530	209.174	132.0
15	36.491	85.030	16	36.427	84.931	7.087	128.831	120.3
15	36.491	85.030	17	36.570	85.130	7.781	314.423	121.1
15	36.491	85.030	18	36.982	86.459	85.970	293.612	141.9
15	36.491	85.030	19	36.951	86.477	86.069	292.030	141.9
15	36.491	85.030	20	37.215	83.835	82.716	52.531	141.6
15	36.491	85.030	21	37.147	83.692	86.674	58.128	142.0
15	36.491	85.030	22	34.481	84.936	138.848	177.795	146.1
15	36.491	85.030	23	34.733	85.019	121.307	179.717	144.9
15	36.491	85.030	24	34.529	84.340	140.807	163.829	146.2
15	36.491	85.030	25	34.321	84.637	151.407	171.497	146.9
15	36.491	85.030	26	37.141	83.479	96.713	61.921	143.0
15	36.491	85.030	27	36.995	83.595	86.618	65.920	142.0
15	36.491	85.030	28	37.089	86.635	97.803	295.435	143.1
15	36.491	85.030	29	37.234	86.601	100.706	301.048	143.3
15	36.491	85.030	30	36.816	83.314	97.578	76.237	143.0
15	36.491	85.030	31	36.788	83.291	98.418	77.500	143.1
16	36.427	84.931	1	35.215	85.031	83.814	183.889	141.7
16	36.427	84.931	2	35.149	85.023	88.300	183.399	142.2
16	36.427	84.931	3	35.231	84.863	82.637	177.361	141.6

16	36.427	84.931	4	35.193	84.559	87.679	166.170	142.1
16	36.427	84.931	5	35.215	84.830	83.812	176.132	141.7
16	36.427	84.931	6	35.168	84.657	88.200	169.932	142.2
16	36.427	84.931	7	35.518	84.779	63.318	172.283	139.3
16	36.427	84.931	8	35.518	84.789	63.244	172.801	139.3
16	36.427	84.931	9	35.730	84.851	48.272	174.729	136.9
16	36.427	84.931	10	35.688	84.863	51.141	175.758	137.4
16	36.427	84.931	11	35.885	84.859	37.603	173.931	134.8
16	36.427	84.931	12	35.942	85.020	33.853	188.488	133.8
16	36.427	84.931	13	36.100	85.039	23.346	194.954	130.6
16	36.427	84.931	14	36.143	85.271	27.252	224.088	132.0
16	36.427	84.931	15	36.491	85.030	7.087	308.890	120.3
16	36.427	84.931	17	36.570	85.130	14.850	311.817	126.7
16	36.427	84.931	18	36.982	86.459	92.827	294.820	142.6
16	36.427	84.931	19	36.951	86.477	92.876	293.353	142.6
16	36.427	84.931	20	37.215	83.835	81.329	47.734	141.5
16	36.427	84.931	21	37.147	83.692	84.597	53.652	141.8
16	36.427	84.931	22	34.481	84.936	134.301	180.135	145.8
16	36.427	84.931	23	34.733	85.019	116.966	182.470	144.6
16	36.427	84.931	24	34.529	84.340	135.062	165.613	145.9
16	36.427	84.931	25	34.321	84.637	146.275	173.436	146.6
16	36.427	84.931	26	37.141	83.479	94.159	58.011	142.7
16	36.427	84.931	27	36.995	83.595	83.629	61.653	141.7
16	36.427	84.931	28	37.089	86.635	104.710	296.392	143.6
16	36.427	84.931	29	37.234	86.601	107.732	301.617	143.9
16	36.427	84.931	30	36.816	83.314	93.443	72.843	142.7
16	36.427	84.931	31	36.788	83.291	94.152	74.191	142.7
17	36.570	85.130	1	35.215	85.031	93.677	176.588	142.7
17	36.570	85.130	2	35.149	85.023	98.220	176.478	143.1
17	36.570	85.130	3	35.231	84.863	93.639	170.743	142.7
17	36.570	85.130	4	35.193	84.559	100.289	161.259	143.3
17	36.570	85.130	5	35.215	84.830	95.006	169.745	142.8
17	36.570	85.130	6	35.168	84.657	100.303	164.571	143.3
17	36.570	85.130	7	35.518	84.779	75.236	164.805	140.8
17	36.570	85.130	8	35.518	84.789	75.089	165.230	140.8
17	36.570	85.130	9	35.730	84.851	60.007	164.910	138.8
17	36.570	85.130	10	35.688	84.863	62.687	166.178	139.2
17	36.570	85.130	11	35.885	84.859	49.629	162.237	137.2
17	36.570	85.130	12	35.942	85.020	43.806	171.915	136.1
17	36.570	85.130	13	36.100	85.039	32.847	171.049	133.6
17	36.570	85.130	14	36.143	85.271	30.514	194.872	132.9
17	36.570	85.130	15	36.491	85.030	7.781	134.364	121.1
17	36.570	85.130	16	36.427	84.931	14.850	131.698	126.7
17	36.570	85.130	18	36.982	86.459	78.745	291.541	141.2
17	36.570	85.130	19	36.951	86.477	78.930	289.818	141.2
17	36.570	85.130	20	37.215	83.835	84.166	57.721	141.8
17	36.570	85.130	21	37.147	83.692	88.840	62.948	142.2
17	36.570	85.130	22	34.481	84.936	144.602	175.619	146.5
17	36.570	85.130	23	34.733	85.019	126.901	177.161	145.3
17	36.570	85.130	24	34.529	84.340	147.635	162.288	146.6
17	36.570	85.130	25	34.321	84.637	157.685	169.733	147.2
17	36.570	85.130	26	37.141	83.479	99.330	66.145	143.2
17	36.570	85.130	27	36.995	83.595	89.761	70.486	142.3
17	36.570	85.130	28	37.089	86.635	90.481	293.772	142.4
17	36.570	85.130	29	37.234	86.601	93.154	299.881	142.6
17	36.570	85.130	30	36.816	83.314	101.895	79.897	143.4
17	36.570	85.130	31	36.788	83.291	102.871	81.074	143.5
18	36.982	86.459	1	35.215	85.031	145.600	146.436	146.5
18	36.982	86.459	2	35.149	85.023	149.665	147.226	146.8
18	36.982	86.459	3	35.231	84.863	150.063	143.163	146.8
18	36.982	86.459	4	35.193	84.559	162.696	138.801	147.5
18	36.982	86.459	5	35.215	84.830	152.019	142.836	146.9
18	36.982	86.459	6	35.168	84.657	160.502	140.704	147.4
18	36.982	86.459	7	35.518	84.779	137.652	136.727	146.0
18	36.982	86.459	8	35.518	84.789	137.264	136.905	146.0
18	36.982	86.459	9	35.730	84.851	124.258	133.550	145.1

18	36.982	86.459	10	35.688	84.863	125.873	134.711	145.2
18	36.982	86.459	11	35.885	84.859	116.682	129.963	144.6
18	36.982	86.459	12	35.942	85.020	107.378	131.518	143.9
18	36.982	86.459	13	36.100	85.039	99.521	127.270	143.2
18	36.982	86.459	14	36.143	85.271	87.692	130.966	142.1
18	36.982	86.459	15	36.491	85.030	85.970	112.757	141.9
18	36.982	86.459	16	36.427	84.931	92.827	113.906	142.6
18	36.982	86.459	17	36.570	85.130	78.745	110.745	141.2
18	36.982	86.459	19	36.951	86.477	2.377	204.353	110.8
18	36.982	86.459	20	37.215	83.835	145.290	82.863	146.5
18	36.982	86.459	21	37.147	83.692	152.796	84.887	146.9
18	36.982	86.459	22	34.481	84.936	192.520	153.250	148.9
18	36.982	86.459	23	34.733	85.019	174.794	152.150	148.1
18	36.982	86.459	24	34.529	84.340	206.657	144.340	149.6
18	36.982	86.459	25	34.321	84.637	210.124	150.378	149.7
18	36.982	86.459	26	37.141	83.479	164.473	85.274	147.6
18	36.982	86.459	27	36.995	83.595	157.853	88.811	147.2
18	36.982	86.459	28	37.089	86.635	12.187	307.545	125.0
18	36.982	86.459	29	37.234	86.601	19.046	335.932	128.8
18	36.982	86.459	30	36.816	83.314	173.910	92.840	148.1
18	36.982	86.459	31	36.788	83.291	175.349	93.436	148.1
19	36.951	86.477	1	35.215	85.031	144.351	145.626	146.4
19	36.951	86.477	2	35.149	85.023	148.389	146.445	146.7
19	36.951	86.477	3	35.231	84.863	148.932	142.351	146.7
19	36.951	86.477	4	35.193	84.559	161.727	138.024	147.4
19	36.951	86.477	5	35.215	84.830	150.899	142.032	146.8
19	36.951	86.477	6	35.168	84.657	159.461	139.928	147.3
19	36.951	86.477	7	35.518	84.779	136.765	135.796	146.0
19	36.951	86.477	8	35.518	84.789	136.370	135.972	145.9
19	36.951	86.477	9	35.730	84.851	123.497	132.498	145.1
19	36.951	86.477	10	35.688	84.863	125.066	133.680	145.2
19	36.951	86.477	11	35.885	84.859	116.065	128.823	144.5
19	36.951	86.477	12	35.942	85.020	106.700	130.288	143.8
19	36.951	86.477	13	36.100	85.039	99.017	125.919	143.2
19	36.951	86.477	14	36.143	85.271	87.042	129.456	142.0
19	36.951	86.477	15	36.491	85.030	86.069	111.165	141.9
19	36.951	86.477	16	36.427	84.931	92.876	112.429	142.6
19	36.951	86.477	17	36.570	85.130	78.930	109.013	141.2
19	36.951	86.477	18	36.982	86.459	2.377	24.342	110.8
19	36.951	86.477	20	37.215	83.835	146.546	82.060	146.6
19	36.951	86.477	21	37.147	83.692	153.980	84.106	147.0
19	36.951	86.477	22	34.481	84.936	191.036	152.685	148.9
19	36.951	86.477	23	34.733	85.019	173.347	151.518	148.0
19	36.951	86.477	24	34.529	84.340	205.479	143.756	149.5
19	36.951	86.477	25	34.321	84.637	208.735	149.840	149.6
19	36.951	86.477	26	37.141	83.479	165.642	84.545	147.6
19	36.951	86.477	27	36.995	83.595	158.892	88.028	147.3
19	36.951	86.477	28	37.089	86.635	12.938	317.839	125.5
19	36.951	86.477	29	37.234	86.601	20.700	340.849	129.6
19	36.951	86.477	30	36.816	83.314	174.796	92.105	148.1
19	36.951	86.477	31	36.788	83.291	176.211	92.704	148.2
20	37.215	83.835	1	35.215	85.031	153.204	206.116	147.0
20	37.215	83.835	2	35.149	85.023	157.112	205.259	147.2
20	37.215	83.835	3	35.231	84.863	148.377	202.984	146.7
20	37.215	83.835	4	35.193	84.559	145.232	196.320	146.5
20	37.215	83.835	5	35.215	84.830	148.681	202.168	146.7
20	37.215	83.835	6	35.168	84.657	148.450	198.202	146.7
20	37.215	83.835	7	35.518	84.779	128.313	204.405	145.4
20	37.215	83.835	8	35.518	84.789	128.547	204.641	145.4
20	37.215	83.835	9	35.730	84.851	116.916	209.134	144.6
20	37.215	83.835	10	35.688	84.863	119.808	208.738	144.8
20	37.215	83.835	11	35.885	84.859	107.892	212.053	143.9
20	37.215	83.835	12	35.942	85.020	109.658	217.126	144.1
20	37.215	83.835	13	36.100	85.039	101.746	221.253	143.4
20	37.215	83.835	14	36.143	85.271	108.540	227.475	144.0
20	37.215	83.835	15	36.491	85.030	82.716	233.247	141.6

20	37.215	83.835	16	36.427	84.931	81.329	228.390	141.5
20	37.215	83.835	17	36.570	85.130	84.166	238.499	141.8
20	37.215	83.835	18	36.982	86.459	145.290	264.446	146.5
20	37.215	83.835	19	36.951	86.477	146.546	263.653	146.6
20	37.215	83.835	21	37.147	83.692	9.166	120.494	122.5
20	37.215	83.835	22	34.481	84.936	198.445	198.399	149.2
20	37.215	83.835	23	34.733	85.019	183.536	201.467	148.5
20	37.215	83.835	24	34.529	84.340	187.422	188.814	148.7
20	37.215	83.835	25	34.321	84.637	204.680	192.907	149.5
20	37.215	83.835	26	37.141	83.479	20.255	104.414	129.4
20	37.215	83.835	27	36.995	83.595	20.117	138.834	129.3
20	37.215	83.835	28	37.089	86.635	154.193	267.632	147.0
20	37.215	83.835	29	37.234	86.601	151.933	271.335	146.9
20	37.215	83.835	30	36.816	83.314	39.785	133.653	135.2
20	37.215	83.835	31	36.788	83.291	42.049	134.346	135.7
21	37.147	83.692	1	35.215	85.031	152.777	209.631	146.9
21	37.147	83.692	2	35.149	85.023	156.542	208.687	147.1
21	37.147	83.692	3	35.231	84.863	147.459	206.603	146.6
21	37.147	83.692	4	35.193	84.559	143.263	199.962	146.4
21	37.147	83.692	5	35.215	84.830	147.632	205.775	146.6
21	37.147	83.692	6	35.168	84.657	146.772	201.786	146.6
21	37.147	83.692	7	35.518	84.779	127.666	208.585	145.4
21	37.147	83.692	8	35.518	84.789	127.938	208.813	145.4
21	37.147	83.692	9	35.730	84.851	117.058	213.709	144.6
21	37.147	83.692	10	35.688	84.863	119.877	213.207	144.8
21	37.147	83.692	11	35.885	84.859	108.528	216.982	144.0
21	37.147	83.692	12	35.942	85.020	111.090	221.913	144.2
21	37.147	83.692	13	36.100	85.039	103.848	226.313	143.6
21	37.147	83.692	14	36.143	85.271	111.562	232.068	144.2
21	37.147	83.692	15	36.491	85.030	86.674	238.930	142.0
21	37.147	83.692	16	36.427	84.931	84.597	234.394	141.8
21	37.147	83.692	17	36.570	85.130	88.840	243.811	142.2
21	37.147	83.692	18	36.982	86.459	152.796	266.555	146.9
21	37.147	83.692	19	36.951	86.477	153.980	265.784	147.0
21	37.147	83.692	20	37.215	83.835	9.166	300.581	122.5
21	37.147	83.692	22	34.481	84.936	196.729	201.095	149.1
21	37.147	83.692	23	34.733	85.019	182.323	204.398	148.5
21	37.147	83.692	24	34.529	84.340	184.233	191.548	148.6
21	37.147	83.692	25	34.321	84.637	202.099	195.470	149.4
21	37.147	83.692	26	37.141	83.479	11.726	91.996	124.6
21	37.147	83.692	27	36.995	83.595	11.775	153.100	124.7
21	37.147	83.692	28	37.089	86.635	161.969	269.478	147.4
21	37.147	83.692	29	37.234	86.601	160.000	273.021	147.3
21	37.147	83.692	30	36.816	83.314	30.930	137.608	133.1
21	37.147	83.692	31	36.788	83.291	33.222	138.221	133.7
22	34.481	84.936	1	35.215	85.031	50.963	353.950	137.4
22	34.481	84.936	2	35.149	85.023	46.417	353.914	136.6
22	34.481	84.936	3	35.231	84.863	51.915	4.549	137.6
22	34.481	84.936	4	35.193	84.559	53.568	23.396	137.8
22	34.481	84.936	5	35.215	84.830	51.030	6.714	137.4
22	34.481	84.936	6	35.168	84.657	49.999	18.339	137.2
22	34.481	84.936	7	35.518	84.779	72.097	7.023	140.4
22	34.481	84.936	8	35.518	84.789	72.028	6.567	140.4
22	34.481	84.936	9	35.730	84.851	86.363	3.150	142.0
22	34.481	84.936	10	35.688	84.863	83.400	2.814	141.7
22	34.481	84.936	11	35.885	84.859	97.003	2.533	143.0
22	34.481	84.936	12	35.942	85.020	100.928	357.338	143.3
22	34.481	84.936	13	36.100	85.039	111.891	357.072	144.2
22	34.481	84.936	14	36.143	85.271	116.231	350.765	144.6
22	34.481	84.936	15	36.491	85.030	138.848	357.850	146.1
22	34.481	84.936	16	36.427	84.931	134.301	0.132	145.8
22	34.481	84.936	17	36.570	85.130	144.602	355.732	146.5
22	34.481	84.936	18	36.982	86.459	192.520	334.140	148.9
22	34.481	84.936	19	36.951	86.477	191.036	333.585	148.9
22	34.481	84.936	20	37.215	83.835	198.445	17.754	149.2
22	34.481	84.936	21	37.147	83.692	196.729	20.366	149.1

22	34.481	84.936	23	34.733	85.019	18.072	344.843	128.4
22	34.481	84.936	24	34.529	84.340	34.047	84.145	133.9
22	34.481	84.936	25	34.321	84.637	20.284	122.890	129.4
22	34.481	84.936	26	37.141	83.479	200.871	23.530	149.3
22	34.481	84.936	27	36.995	83.595	189.052	23.020	148.8
22	34.481	84.936	28	37.089	86.635	203.569	332.651	149.4
22	34.481	84.936	29	37.234	86.601	211.547	334.381	149.8
22	34.481	84.936	30	36.816	83.314	185.001	28.974	148.6
22	34.481	84.936	31	36.788	83.291	183.971	29.618	148.5
23	34.733	85.019	1	35.215	85.031	33.242	358.839	133.7
23	34.733	85.019	2	35.149	85.023	28.713	359.562	132.4
23	34.733	85.019	3	35.231	84.863	35.429	14.406	134.2
23	34.733	85.019	4	35.193	84.559	41.012	39.288	135.5
23	34.733	85.019	5	35.215	84.830	34.914	17.784	134.1
23	34.733	85.019	6	35.168	84.657	36.324	34.227	134.5
23	34.733	85.019	7	35.518	84.779	55.781	14.000	138.2
23	34.733	85.019	8	35.518	84.789	55.643	13.424	138.2
23	34.733	85.019	9	35.730	84.851	69.438	7.792	140.1
23	34.733	85.019	10	35.688	84.863	66.444	7.580	139.7
23	34.733	85.019	11	35.885	84.859	79.974	6.422	141.3
23	34.733	85.019	12	35.942	85.020	83.375	359.979	141.7
23	34.733	85.019	13	36.100	85.039	94.306	359.351	142.7
23	34.733	85.019	14	36.143	85.271	98.273	351.804	143.1
23	34.733	85.019	15	36.491	85.030	.121.307	359.723	144.9
23	34.733	85.019	16	36.427	84.931	116.966	2.418	144.6
23	34.733	85.019	17	36.570	85.130	126.901	357.225	145.3
23	34.733	85.019	18	36.982	86.459	174.794	332.993	148.1
23	34.733	85.019	19	36.951	86.477	173.347	332.372	148.0
23	34.733	85.019	20	37.215	83.835	183.536	20.771	148.5
23	34.733	85.019	21	37.147	83.692	182.323	23.618	148.5
23	34.733	85.019	22	34.481	84.936	18.072	164.795	128.4
23	34.733	85.019	24	34.529	84.340	41.046	109.851	135.5
23	34.733	85.019	25	34.321	84.637	35.823	142.552	134.3
23	34.733	85.019	26	37.141	83.479	187.105	26.941	148.7
23	34.733	85.019	27	36.995	83.595	175.201	26.626	148.1
23	34.733	85.019	28	37.089	86.635	185.944	331.429	148.6
23	34.733	85.019	29	37.234	86.601	193.802	333.365	149.0
23	34.733	85.019	30	36.816	83.314	172.489	33.107	148.0
23	34.733	85.019	31	36.788	83.291	171.614	33.822	147.9
24	34.529	84.340	1	35.215	85.031	61.386	320.604	139.0
24	34.529	84.340	2	35.149	85.023	57.675	318.074	138.5
24	34.529	84.340	3	35.231	84.863	56.709	328.696	138.3
24	34.529	84.340	4	35.193	84.559	47.395	344.924	136.8
24	34.529	84.340	5	35.215	84.830	54.836	329.752	138.0
24	34.529	84.340	6	35.168	84.657	47.579	337.930	136.8
24	34.529	84.340	7	35.518	84.779	72.546	340.136	140.5
24	34.529	84.340	8	35.518	84.789	72.747	339.709	140.5
24	34.529	84.340	9	35.730	84.851	87.734	340.954	142.1
24	34.529	84.340	10	35.688	84.863	85.198	339.885	141.9
24	34.529	84.340	11	35.885	84.859	98.006	342.773	143.1
24	34.529	84.340	12	35.942	85.020	104.702	338.734	143.6
24	34.529	84.340	13	36.100	85.039	115.280	340.259	144.5
24	34.529	84.340	14	36.143	85.271	123.026	335.070	145.0
24	34.529	84.340	15	36.491	85.030	140.807	344.230	146.2
24	34.529	84.340	16	36.427	84.931	135.062	345.955	145.9
24	34.529	84.340	17	36.570	85.130	147.635	342.747	146.6
24	34.529	84.340	18	36.982	86.459	206.657	325.579	149.6
24	34.529	84.340	19	36.951	86.477	205.479	325.004	149.5
24	34.529	84.340	20	37.215	83.835	187.422	8.518	148.7
24	34.529	84.340	21	37.147	83.692	184.233	11.169	148.6
24	34.529	84.340	22	34.481	84.936	34.047	264.483	133.9
24	34.529	84.340	23	34.733	85.019	41.046	290.237	135.5
24	34.529	84.340	25	34.321	84.637	22.212	229.626	130.2
24	34.529	84.340	26	37.141	83.479	186.537	14.724	148.7
24	34.529	84.340	27	36.995	83.595	175.164	13.565	148.1
24	34.529	84.340	28	37.089	86.635	218.352	324.654	150.0

24	34.529	84.340	29	37.234	86.601	225.347	326.552	150.3
24	34.529	84.340	30	36.816	83.314	167.897	19.736	147.8
24	34.529	84.340	31	36.788	83.291	166.535	20.378	147.7
25	34.321	84.637	1	35.215	85.031	65.636	340.211	139.6
25	34.321	84.637	2	35.149	85.023	61.240	339.163	139.0
25	34.321	84.637	3	35.231	84.863	64.081	348.543	139.4
25	34.321	84.637	4	35.193	84.559	60.328	4.199	138.9
25	34.321	84.637	5	35.215	84.830	62.679	350.001	139.2
25	34.321	84.637	6	35.168	84.657	58.488	358.895	138.6
25	34.321	84.637	7	35.518	84.779	82.979	354.487	141.6
25	34.321	84.637	8	35.518	84.789	83.037	354.090	141.6
25	34.321	84.637	9	35.730	84.851	98.021	352.970	143.1
25	34.321	84.637	10	35.688	84.863	95.198	352.359	142.8
25	34.321	84.637	11	35.885	84.859	108.673	353.435	144.0
25	34.321	84.637	12	35.942	85.020	113.923	349.180	144.4
25	34.321	84.637	13	36.100	85.039	124.849	349.673	145.2
25	34.321	84.637	14	36.143	85.271	130.705	344.326	145.6
25	34.321	84.637	15	36.491	85.030	151.407	351.724	146.9
25	34.321	84.637	16	36.427	84.931	146.275	353.606	146.6
25	34.321	84.637	17	36.570	85.130	157.685	350.019	147.2
25	34.321	84.637	18	36.982	86.459	210.124	331.441	149.7
25	34.321	84.637	19	36.951	86.477	208.735	330.913	149.6
25	34.321	84.637	20	37.215	83.835	204.680	12.438	149.5
25	34.321	84.637	21	37.147	83.692	202.099	14.917	149.4
25	34.321	84.637	22	34.481	84.936	20.284	303.059	129.4
25	34.321	84.637	23	34.733	85.019	35.823	322.769	134.3
25	34.321	84.637	24	34.529	84.340	22.212	49.458	130.2
25	34.321	84.637	26	37.141	83.479	205.148	18.105	149.5
25	34.321	84.637	27	36.995	83.595	193.562	17.268	149.0
25	34.321	84.637	28	37.089	86.635	221.407	330.216	150.2
25	34.321	84.637	29	37.234	86.601	229.088	331.902	150.5
25	34.321	84.637	30	36.816	83.314	187.482	22.950	148.7
25	34.321	84.637	31	36.788	83.291	186.232	23.549	148.7
26	37.141	83.479	1	35.215	85.031	158.557	213.515	147.3
26	37.141	83.479	2	35.149	85.023	162.147	212.518	147.4
26	37.141	83.479	3	35.231	84.863	152.714	210.733	146.9
26	37.141	83.479	4	35.193	84.559	147.303	204.432	146.6
26	37.141	83.479	5	35.215	84.830	152.738	209.931	146.9
26	37.141	83.479	6	35.168	84.657	151.145	206.099	146.8
26	37.141	83.479	7	35.518	84.779	133.327	213.223	145.7
26	37.141	83.479	8	35.518	84.789	133.638	213.431	145.8
26	37.141	83.479	9	35.730	84.851	123.624	218.464	145.1
26	37.141	83.479	10	35.688	84.863	126.352	217.887	145.3
26	37.141	83.479	11	35.885	84.859	115.651	221.874	144.5
26	37.141	83.479	12	35.942	85.020	118.955	226.377	144.8
26	37.141	83.479	13	36.100	85.039	112.354	230.723	144.3
26	37.141	83.479	14	36.143	85.271	120.788	235.768	144.9
26	37.141	83.479	15	36.491	85.030	96.713	242.851	143.0
26	37.141	83.479	16	36.427	84.931	94.159	238.880	142.7
26	37.141	83.479	17	36.570	85.130	99.330	247.136	143.2
26	37.141	83.479	18	36.982	86.459	164.473	267.071	147.6
26	37.141	83.479	19	36.951	86.477	165.642	266.352	147.6
26	37.141	83.479	20	37.215	83.835	20.255	284.630	129.4
26	37.141	83.479	21	37.147	83.692	11.726	272.125	124.6
26	37.141	83.479	22	34.481	84.936	200.871	204.383	149.3
26	37.141	83.479	23	34.733	85.019	187.105	207.846	148.7
26	37.141	83.479	24	34.529	84.340	186.537	195.228	148.7
26	37.141	83.479	25	34.321	84.637	205.148	198.782	149.5
26	37.141	83.479	27	36.995	83.595	11.946	212.475	124.8
26	37.141	83.479	28	37.089	86.635	173.685	269.777	148.0
26	37.141	83.479	29	37.234	86.601	171.724	273.079	147.9
26	37.141	83.479	30	36.816	83.314	24.223	157.975	130.9
26	37.141	83.479	31	36.788	83.291	26.499	156.983	131.7
27	36.995	83.595	1	35.215	85.031	146.613	213.529	146.6
27	36.995	83.595	2	35.149	85.023	150.201	212.451	146.8
27	36.995	83.595	3	35.231	84.863	140.774	210.515	146.2

27	36.995	83.595	4	35.193	84.559	135.485	203.655	145.9
27	36.995	83.595	5	35.215	84.830	140.805	209.645	146.2
27	36.995	83.595	6	35.168	84.657	139.280	205.483	146.1
27	36.995	83.595	7	35.518	84.779	121.383	213.226	144.9
27	36.995	83.595	8	35.518	84.789	121.694	213.455	145.0
27	36.995	83.595	9	35.730	84.851	111.751	219.033	144.2
27	36.995	83.595	10	35.688	84.863	114.465	218.380	144.4
27	36.995	83.595	11	35.885	84.859	103.884	222.880	143.6
27	36.995	83.595	12	35.942	85.020	107.397	227.837	143.9
27	36.995	83.595	13	36.100	85.039	101.078	232.773	143.3
27	36.995	83.595	14	36.143	85.271	109.918	238.160	144.1
27	36.995	83.595	15	36.491	85.030	86.618	246.779	142.0
27	36.995	83.595	16	36.427	84.931	83.629	242.452	141.7
27	36.995	83.595	17	36.570	85.130	89.761	251.405	142.3
27	36.995	83.595	18	36.982	86.459	157.853	90.535	147.2
27	36.995	83.595	19	36.951	86.477	158.892	269.761	147.3
27	36.995	83.595	20	37.215	83.835	20.117	318.979	129.3
27	36.995	83.595	21	37.147	83.692	11.775	333.158	124.7
27	36.995	83.595	22	34.481	84.936	189.052	203.804	148.8
27	36.995	83.595	23	34.733	85.019	175.201	207.460	148.1
27	36.995	83.595	24	34.529	84.340	175.164	194.001	148.1
27	36.995	83.595	25	34.321	84.637	193.562	197.875	149.0
27	36.995	83.595	26	37.141	83.479	11.946	32.405	124.8
27	36.995	83.595	28	37.089	86.635	167.533	273.144	147.7
27	36.995	83.595	29	37.234	86.601	166.186	276.598	147.7
27	36.995	83.595	30	36.816	83.314	19.834	128.543	129.2
27	36.995	83.595	31	36.788	83.291	22.050	130.398	130.1
28	37.089	86.635	1	35.215	85.031	157.180	144.893	147.2
28	37.089	86.635	2	35.149	85.023	161.193	145.662	147.4
28	37.089	86.635	3	35.231	84.863	161.834	141.896	147.4
28	37.089	86.635	4	35.193	84.559	174.665	137.915	148.1
28	37.089	86.635	5	35.215	84.830	163.806	141.606	147.5
28	37.089	86.635	6	35.168	84.657	172.391	139.677	148.0
28	37.089	86.635	7	35.518	84.779	149.695	135.877	146.8
28	37.089	86.635	8	35.518	84.789	149.302	136.039	146.7
28	37.089	86.635	9	35.730	84.851	136.384	132.909	145.9
28	37.089	86.635	10	35.688	84.863	137.973	133.974	146.0
28	37.089	86.635	11	35.885	84.859	128.859	129.629	145.5
28	37.089	86.635	12	35.942	85.020	119.538	131.008	144.8
28	37.089	86.635	13	36.100	85.039	111.708	127.194	144.2
28	37.089	86.635	14	36.143	85.271	99.860	130.443	143.2
28	37.089	86.635	15	36.491	85.030	97.803	114.474	143.1
28	37.089	86.635	16	36.427	84.931	104.710	115.372	143.6
28	37.089	86.635	17	36.570	85.130	90.481	112.870	142.4
28	37.089	86.635	18	36.982	86.459	12.187	127.439	125.0
28	37.089	86.635	19	36.951	86.477	12.938	137.744	125.5
28	37.089	86.635	20	37.215	83.835	154.193	85.942	147.0
28	37.089	86.635	21	37.147	83.692	161.969	87.702	147.4
28	37.089	86.635	22	34.481	84.936	203.569	151.658	149.4
28	37.089	86.635	23	34.733	85.019	185.944	150.481	148.6
28	37.089	86.635	24	34.529	84.340	218.352	143.311	150.0
28	37.089	86.635	25	34.321	84.637	221.407	149.050	150.2
28	37.089	86.635	26	37.141	83.479	173.685	87.872	148.0
28	37.089	86.635	27	36.995	83.595	167.533	91.313	147.7
28	37.089	86.635	29	37.234	86.601	10.142	10.665	123.4
28	37.089	86.635	30	36.816	83.314	184.059	94.893	148.5
28	37.089	86.635	31	36.788	83.291	185.565	95.439	148.6
29	37.234	86.601	1	35.215	85.031	164.415	147.445	147.6
29	37.234	86.601	2	35.149	85.023	168.516	148.120	147.8
29	37.234	86.601	3	35.231	84.863	168.691	144.507	147.8
29	37.234	86.601	4	35.193	84.559	180.984	140.491	148.4
29	37.234	86.601	5	35.215	84.830	170.624	144.199	147.9
29	37.234	86.601	6	35.168	84.657	178.949	142.220	148.3
29	37.234	86.601	7	35.518	84.779	155.764	138.946	147.1
29	37.234	86.601	8	35.518	84.789	155.394	139.109	147.1
29	37.234	86.601	9	35.730	84.851	142.054	136.390	146.3

29	37.234	86.601	10	35.688	84.863	143.792	137.373	146.4
29	37.234	86.601	11	35.885	84.859	134.064	133.443	145.8
29	37.234	86.601	12	35.942	85.020	124.969	135.044	145.2
29	37.234	86.601	13	36.100	85.039	116.592	131.678	144.6
29	37.234	86.601	14	36.143	85.271	105.265	135.260	143.7
29	37.234	86.601	15	36.491	85.030	100.706	120.106	143.3
29	37.234	86.601	16	36.427	84.931	107.732	120.616	143.9
29	37.234	86.601	17	36.570	85.130	93.154	118.999	142.6
29	37.234	86.601	18	36.982	86.459	19.046	155.846	128.8
29	37.234	86.601	19	36.951	86.477	20.700	160.775	129.6
29	37.234	86.601	20	37.215	83.835	151.933	269.662	146.9
29	37.234	86.601	21	37.147	83.692	160.000	91.262	147.3
29	37.234	86.601	22	34.481	84.936	211.547	153.406	149.8
29	37.234	86.601	23	34.733	85.019	193.802	152.435	149.0
29	37.234	86.601	24	34.529	84.340	225.347	145.227	150.3
29	37.234	86.601	25	34.321	84.637	229.088	150.754	150.5
29	37.234	86.601	26	37.141	83.479	171.724	91.192	147.9
29	37.234	86.601	27	36.995	83.595	166.186	94.784	147.7
29	37.234	86.601	28	37.089	86.635	10.142	190.685	123.4
29	37.234	86.601	30	36.816	83.314	183.317	98.067	148.5
29	37.234	86.601	31	36.788	83.291	184.917	98.589	148.6
30	36.816	83.314	1	35.215	85.031	146.220	221.460	146.6
30	36.816	83.314	2	35.149	85.023	149.403	220.202	146.7
30	36.816	83.314	3	35.231	84.863	139.394	218.779	146.1
30	36.816	83.314	4	35.193	84.559	131.789	212.183	145.6
30	36.816	83.314	5	35.215	84.830	139.123	217.907	146.1
30	36.816	83.314	6	35.168	84.657	136.174	213.805	145.9
30	36.816	83.314	7	35.518	84.779	121.164	222.772	144.9
30	36.816	83.314	8	35.518	84.789	121.551	222.975	144.9
30	36.816	83.314	9	35.730	84.851	113.664	229.248	144.4
30	36.816	83.314	10	35.688	84.863	116.115	228.381	144.5
30	36.816	83.314	11	35.885	84.859	107.223	233.675	143.9
30	36.816	83.314	12	35.942	85.020	112.318	238.040	144.3
30	36.816	83.314	13	36.100	85.039	107.683	243.224	143.9
30	36.816	83.314	14	36.143	85.271	118.064	247.431	144.7
30	36.816	83.314	15	36.491	85.030	97.578	257.262	143.0
30	36.816	83.314	16	36.427	84.931	93.443	253.807	142.7
30	36.816	83.314	17	36.570	85.130	101.895	260.983	143.4
30	36.816	83.314	18	36.982	86.459	173.910	274.728	148.1
30	36.816	83.314	19	36.951	86.477	174.796	274.003	148.1
30	36.816	83.314	20	37.215	83.835	39.785	313.967	135.2
30	36.816	83.314	21	37.147	83.692	30.930	317.836	133.1
30	36.816	83.314	22	34.481	84.936	185.001	209.919	148.6
30	36.816	83.314	23	34.733	85.019	172.489	214.104	148.0
30	36.816	83.314	24	34.529	84.340	167.897	200.334	147.8
30	36.816	83.314	25	34.321	84.637	187.482	203.720	148.7
30	36.816	83.314	26	37.141	83.479	24.223	338.074	130.9
30	36.816	83.314	27	36.995	83.595	19.834	308.712	129.2
30	36.816	83.314	28	37.089	86.635	184.059	276.890	148.5
30	36.816	83.314	29	37.234	86.601	183.317	280.046	148.5
30	36.816	83.314	31	36.788	83.291	2.317	146.648	110.5
31	36.788	83.291	1	35.215	85.031	145.630	222.353	146.5
31	36.788	83.291	2	35.149	85.023	148.764	221.071	146.7
31	36.788	83.291	3	35.231	84.863	138.700	219.704	146.1
31	36.788	83.291	4	35.193	84.559	130.847	213.121	145.6
31	36.788	83.291	5	35.215	84.830	138.396	218.829	146.1
31	36.788	83.291	6	35.168	84.657	135.292	214.723	145.9
31	36.788	83.291	7	35.518	84.779	120.630	223.854	144.9
31	36.788	83.291	8	35.518	84.789	121.024	224.054	144.9
31	36.788	83.291	9	35.730	84.851	113.388	230.423	144.3
31	36.788	83.291	10	35.688	84.863	115.804	229.530	144.5
31	36.788	83.291	11	35.885	84.859	107.128	234.926	143.8
31	36.788	83.291	12	35.942	85.020	112.399	239.234	144.3
31	36.788	83.291	13	36.100	85.039	107.973	244.460	143.9
31	36.788	83.291	14	36.143	85.271	118.519	248.545	144.7
31	36.788	83.291	15	36.491	85.030	98.418	258.538	143.1

31	36.788	83.291	16	36.427	84.931	94.152	255.169	142.7
31	36.788	83.291	17	36.570	85.130	102.871	262.172	143.5
31	36.788	83.291	18	36.982	86.459	175.349	275.338	148.1
31	36.788	83.291	19	36.951	86.477	176.211	274.616	148.2
31	36.788	83.291	20	37.215	83.835	42.049	314.674	135.7
31	36.788	83.291	21	37.147	83.692	33.222	318.462	133.7
31	36.788	83.291	22	34.481	84.936	183.971	210.577	148.5
31	36.788	83.291	23	34.733	85.019	171.614	214.832	147.9
31	36.788	83.291	24	34.529	84.340	166.535	200.990	147.7
31	36.788	83.291	25	34.321	84.637	186.232	204.332	148.7
31	36.788	83.291	26	37.141	83.479	26.499	337.095	131.7
31	36.788	83.291	27	36.995	83.595	22.050	310.580	130.1
31	36.788	83.291	28	37.089	86.635	185.565	277.449	148.6
31	36.788	83.291	29	37.234	86.601	184.917	280.581	148.6
31	36.788	83.291	30	36.816	83.314	2.317	326.661	110.5

STOP --

APPENDIX B

The results presented in this section describe the extent to which two microwave signals will interfere with each other assuming free-space propagation characteristics. The results may be used for both inter- and intra-system interference analysis. A column-by-column description of the data follows.

COLUMN 1: The transmitting node designation for the intended path.

COLUMN 2: The receiving node designation for the intended path.

COLUMN 3: The power in dBm of the node identified in COLUMN 1.

COLUMN 4: The gain in dB of the transmitting antenna at the node identified in COLUMN 1.

COLUMN 5: The transmitting node designation source.

COLUMN 6: The receiving node designation associated with the node identified in COLUMN 5.

COLUMN 7: The power in dBm of the node identified in COLUMN 5.

COLUMN 8: The gain in dB of the receiving antenna at the node identified in COLUMN 6.

COLUMN 9: The carrier-to-interference ratio in dB for the combination defined in COLUMNS 1-8.

For the data presented in this section, the node designations 1 through 17 correspond to the proposed VEC nodes defined in Table 2-1 and the node designations 18-35 correspond to existing nodes which are co- or adjacent-channel to the proposed VEC trunk links. Nodes 18-35 are defined in Table 4-4.

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RUN IXCAA.SAV
INPUT FROM TTY (0) OR FILE (1)?
1
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INTENDED SIGNAL				INTERFERING SIGNAL				CARRIER/ INTERF. RATIO
FR	TO	POWER	GAIN	FR	TO	POWER	GAIN	
2	1	12.4	33.0	1	2	12.4	33.0	-48.8
2	3	8.8	33.0	1	2	12.4	33.0	46.5
2	4	19.7	33.0	1	2	12.4	33.0	48.4
3	2	8.8	33.0	1	2	12.4	33.0	28.0
3	5	-20.2	33.0	1	2	12.4	33.0	39.9
4	2	21.7	33.0	1	2	12.4	33.0	33.0
4	6	9.5	33.0	1	2	12.4	33.0	76.4
4	7	21.4	33.0	1	2	12.4	33.0	76.9
5	3	-20.2	33.0	1	2	12.4	33.0	48.4
6	4	9.5	33.0	1	2	12.4	33.0	61.4
7	4	21.4	33.0	1	2	12.4	33.0	67.4
7	8	8.1	33.0	1	2	12.4	33.0	100.4
7	9	24.9	33.0	1	2	12.4	33.0	88.2
8	7	-6.9	33.0	1	2	12.4	33.0	81.5
9	7	12.9	33.0	1	2	12.4	33.0	76.9
9	10	5.8	33.0	1	2	12.4	33.0	92.5
9	11	23.8	33.0	1	2	12.4	33.0	81.3
10	9	0.8	33.0	1	2	12.4	33.0	49.2
11	9	8.8	33.0	1	2	12.4	33.0	85.2
11	12	8.1	33.0	1	2	12.4	33.0	77.9
11	13	18.3	33.0	1	2	12.4	33.0	84.6
12	11	8.1	33.0	1	2	12.4	33.0	81.4
13	11	18.3	33.0	1	2	12.4	33.0	86.3
13	14	10.7	33.0	1	2	12.4	33.0	80.2
13	15	21.9	33.0	1	2	12.4	33.0	58.8
14	13	10.7	33.0	1	2	12.4	33.0	83.6
15	13	21.9	33.0	1	2	12.4	33.0	94.6
15	16	0.3	33.0	1	2	12.4	33.0	81.4
15	17	1.1	33.0	1	2	12.4	33.0	78.3
16	15	0.3	33.0	1	2	12.4	33.0	77.8
17	15	1.1	33.0	1	2	12.4	33.0	81.8
18	19	30.0	24.9	1	2	12.4	33.0	83.3
19	18	30.0	24.9	1	2	12.4	33.0	46.1
20	21	30.0	24.9	1	2	12.4	33.0	94.1
21	20	30.0	24.9	1	2	12.4	33.0	87.4
22	23	18.4	24.6	1	2	12.4	33.0	105.4
23	22	18.4	24.6	1	2	12.4	33.0	101.4
24	25	18.4	24.6	1	2	12.4	33.0	102.8
25	24	18.4	24.6	1	2	12.4	33.0	106.8
26	27	18.4	24.6	1	2	12.4	33.0	90.1
27	26	18.4	24.6	1	2	12.4	33.0	90.1
28	29	30.0	25.1	1	2	12.4	33.0	54.0
29	28	30.0	25.1	1	2	12.4	33.0	30.7
30	31	30.0	25.1	1	2	12.4	33.0	76.1
31	30	30.0	25.1	1	2	12.4	33.0	76.5
32	33	18.4	24.6	1	2	12.4	33.0	97.4
33	32	18.4	24.6	1	2	12.4	33.0	59.1
34	35	18.4	24.6	1	2	12.4	33.0	89.8
35	34	18.4	24.6	1	2	12.4	33.0	93.5
1	2	12.4	33.0	2	1	12.4	33.0	-25.8
2	3	8.8	33.0	2	1	12.4	33.0	35.4
2	4	19.7	33.0	2	1	12.4	33.0	46.3
3	2	8.8	33.0	2	1	12.4	33.0	-46.7

3	5	-20.2	33.0	2	1	12.4	33.0	50.2
4	2	21.7	33.0	2	1	12.4	33.0	-58.7
4	6	9.5	33.0	2	1	12.4	33.0	86.2
4	7	21.4	33.0	2	1	12.4	33.0	78.0
5	3	-20.2	33.0	2	1	12.4	33.0	53.3
6	4	9.5	33.0	2	1	12.4	33.0	67.3
7	4	21.4	33.0	2	1	12.4	33.0	77.2
7	8	8.1	33.0	2	1	12.4	33.0	101.6
7	9	24.9	33.0	2	1	12.4	33.0	82.1
8	7	-6.9	33.0	2	1	12.4	33.0	82.7
9	7	12.9	33.0	2	1	12.4	33.0	78.1
9	10	5.8	33.0	2	1	12.4	33.0	93.5
9	11	23.8	33.0	2	1	12.4	33.0	82.1
10	9	0.8	33.0	2	1	12.4	33.0	50.1
11	9	8.8	33.0	2	1	12.4	33.0	86.1
11	12	8.1	33.0	2	1	12.4	33.0	78.6
11	13	18.3	33.0	2	1	12.4	33.0	46.2
12	11	8.1	33.0	2	1	12.4	33.0	82.1
13	11	18.3	33.0	2	1	12.4	33.0	87.1
13	14	10.7	33.0	2	1	12.4	33.0	53.7
13	15	21.9	33.0	2	1	12.4	33.0	32.2
14	13	10.7	33.0	2	1	12.4	33.0	45.2
15	13	21.9	33.0	2	1	12.4	33.0	56.2
15	16	0.3	33.0	2	1	12.4	33.0	81.8
15	17	1.1	33.0	2	1	12.4	33.0	39.7
16	15	0.3	33.0	2	1	12.4	33.0	51.2
17	15	1.1	33.0	2	1	12.4	33.0	55.2
18	19	30.0	24.9	2	1	12.4	33.0	99.8
19	18	30.0	24.9	2	1	12.4	33.0	62.7
20	21	30.0	24.9	2	1	12.4	33.0	103.9
21	20	30.0	24.9	2	1	12.4	33.0	97.2
22	23	18.4	24.6	2	1	12.4	33.0	88.6
23	22	18.4	24.6	2	1	12.4	33.0	84.7
24	25	18.4	24.6	2	1	12.4	33.0	103.0
25	24	18.4	24.6	2	1	12.4	33.0	107.0
26	27	18.4	24.6	2	1	12.4	33.0	90.3
27	26	18.4	24.6	2	1	12.4	33.0	90.3
28	29	30.0	25.1	2	1	12.4	33.0	91.7
29	28	30.0	25.1	2	1	12.4	33.0	68.9
30	31	30.0	25.1	2	1	12.4	33.0	96.5
31	30	30.0	25.1	2	1	12.4	33.0	86.0
32	33	18.4	24.6	2	1	12.4	33.0	97.6
33	32	18.4	24.6	2	1	12.4	33.0	59.3
34	35	18.4	24.6	2	1	12.4	33.0	73.1
35	34	18.4	24.6	2	1	12.4	33.0	76.7
1	2	12.4	33.0	2	3	8.8	33.0	-32.2
2	1	12.4	33.0	2	3	8.8	33.0	42.6
2	4	19.7	33.0	2	3	8.8	33.0	32.9
3	2	8.8	33.0	2	3	8.8	33.0	-53.1
3	5	-20.2	33.0	2	3	8.8	33.0	26.8
4	2	21.7	33.0	2	3	8.8	33.0	-65.1
4	6	9.5	33.0	2	3	8.8	33.0	72.8
4	7	21.4	33.0	2	3	8.8	33.0	64.6
5	3	-20.2	33.0	2	3	8.8	33.0	17.9
6	4	9.5	33.0	2	3	8.8	33.0	53.9
7	4	21.4	33.0	2	3	8.8	33.0	63.8
7	8	8.1	33.0	2	3	8.8	33.0	95.2
7	9	24.9	33.0	2	3	8.8	33.0	75.7
8	7	-6.9	33.0	2	3	8.8	33.0	69.3
9	7	12.9	33.0	2	3	8.8	33.0	64.7
9	10	5.8	33.0	2	3	8.8	33.0	87.1
9	11	23.8	33.0	2	3	8.8	33.0	75.7
10	9	0.8	33.0	2	3	8.8	33.0	43.7
11	9	8.8	33.0	2	3	8.8	33.0	79.7
11	12	8.1	33.0	2	3	8.8	33.0	72.2
11	13	18.3	33.0	2	3	8.8	33.0	88.8

12	11	8.1	33.0	2	3	8.8	33.0	75.7
13	11	18.3	33.0	2	3	8.8	33.0	80.7
13	14	10.7	33.0	2	3	8.8	33.0	84.3
13	15	21.9	33.0	2	3	8.8	33.0	62.8
14	13	10.7	33.0	2	3	8.8	33.0	87.8
15	13	21.9	33.0	2	3	8.8	33.0	98.8
15	16	0.3	33.0	2	3	8.8	33.0	75.4
15	17	1.1	33.0	2	3	8.8	33.0	82.3
16	15	0.3	33.0	2	3	8.8	33.0	81.8
17	15	1.1	33.0	2	3	8.8	33.0	85.8
18	19	30.0	24.9	2	3	8.8	33.0	97.4
19	18	30.0	24.9	2	3	8.8	33.0	60.3
20	21	30.0	24.9	2	3	8.8	33.0	97.5
21	20	30.0	24.9	2	3	8.8	33.0	90.8
22	23	18.4	24.6	2	3	8.8	33.0	109.2
23	22	18.4	24.6	2	3	8.8	33.0	105.3
24	25	18.4	24.6	2	3	8.8	33.0	96.6
25	24	18.4	24.6	2	3	8.8	33.0	100.6
26	27	18.4	24.6	2	3	8.8	33.0	83.9
27	26	18.4	24.6	2	3	8.8	33.0	83.9
28	29	30.0	25.1	2	3	8.8	33.0	89.3
29	28	30.0	25.1	2	3	8.8	33.0	66.5
30	31	30.0	25.1	2	3	8.8	33.0	94.1
31	30	30.0	25.1	2	3	8.8	33.0	79.6
32	33	18.4	24.6	2	3	8.8	33.0	84.2
33	32	18.4	24.6	2	3	8.8	33.0	45.9
34	35	18.4	24.6	2	3	8.8	33.0	93.7
35	34	18.4	24.6	2	3	8.8	33.0	97.3
1	2	12.4	33.0	2	4	19.7	33.0	-60.1
2	1	12.4	33.0	2	4	19.7	33.0	31.7
2	3	8.8	33.0	2	4	19.7	33.0	11.1
3	2	8.8	33.0	2	4	19.7	33.0	-81.0
3	5	-20.2	33.0	2	4	19.7	33.0	25.9
X FOR DIST =			0.10000D+01					
X FOR DIST =			0.10000D+01					
4	2	21.7	33.0	2	4	19.7	33.0	-93.0
X FOR DIST =			0.10000D+01					
X FOR DIST =			0.10000D+01					
4	6	9.5	33.0	2	4	19.7	33.0	39.9
X FOR DIST =			0.10000D+01					
X FOR DIST =			0.10000D+01					
4	7	21.4	33.0	2	4	19.7	33.0	60.7
5	3	-20.2	33.0	2	4	19.7	33.0	29.0
X FOR DIST =			0.10000D+01					
X FOR DIST =			0.10000D+01					
6	4	9.5	33.0	2	4	19.7	33.0	21.0
X FOR DIST =			0.10000D+01					
X FOR DIST =			0.10000D+01					
7	4	21.4	33.0	2	4	19.7	33.0	30.9
7	8	8.1	33.0	2	4	19.7	33.0	84.3
7	9	24.9	33.0	2	4	19.7	33.0	64.8
8	7	-6.9	33.0	2	4	19.7	33.0	65.4
9	7	12.9	33.0	2	4	19.7	33.0	60.8
9	10	5.8	33.0	2	4	19.7	33.0	76.2
9	11	23.8	33.0	2	4	19.7	33.0	64.8
10	9	0.8	33.0	2	4	19.7	33.0	32.8
11	9	8.8	33.0	2	4	19.7	33.0	68.8
11	12	8.1	33.0	2	4	19.7	33.0	61.3
11	13	18.3	33.0	2	4	19.7	33.0	77.9
12	11	8.1	33.0	2	4	19.7	33.0	64.8
13	11	18.3	33.0	2	4	19.7	33.0	69.8
13	14	10.7	33.0	2	4	19.7	33.0	73.4
13	15	21.9	33.0	2	4	19.7	33.0	51.9
14	13	10.7	33.0	2	4	19.7	33.0	76.9
15	13	21.9	33.0	2	4	19.7	33.0	87.9
15	16	0.3	33.0	2	4	19.7	33.0	64.5

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	17	1.1	33.0	2	4	19.7	33.0	71.4
16	15	0.3	33.0	2	4	19.7	33.0	70.9
17	15	1.1	33.0	2	4	19.7	33.0	74.9
18	19	30.0	24.9	2	4	19.7	33.0	86.5
19	18	30.0	24.9	2	4	19.7	33.0	49.4
20	21	30.0	24.9	2	4	19.7	33.0	86.6
21	20	30.0	24.9	2	4	19.7	33.0	79.9
22	23	18.4	24.6	2	4	19.7	33.0	98.3
23	22	18.4	24.6	2	4	19.7	33.0	94.4
24	25	18.4	24.6	2	4	19.7	33.0	85.7
25	24	18.4	24.6	2	4	19.7	33.0	89.7
26	27	18.4	24.6	2	4	19.7	33.0	73.0
27	26	18.4	24.6	2	4	19.7	33.0	73.0
28	29	30.0	25.1	2	4	19.7	33.0	74.4
29	28	30.0	25.1	2	4	19.7	33.0	51.6
30	31	30.0	25.1	2	4	19.7	33.0	79.2
31	30	30.0	25.1	2	4	19.7	33.0	68.7
32	33	18.4	24.6	2	4	19.7	33.0	80.3
33	32	18.4	24.6	2	4	19.7	33.0	42.0
34	35	18.4	24.6	2	4	19.7	33.0	82.8
35	34	18.4	24.6	2	4	19.7	33.0	86.4
1	2	12.4	33.0	3	2	8.8	33.0	50.0
2	1	12.4	33.0	3	2	8.8	33.0	61.0
2	3	8.8	33.0	3	2	8.8	33.0	-31.4
2	4	19.7	33.0	3	2	8.8	33.0	62.3
3	5	-20.2	33.0	3	2	8.8	33.0	4.0
4	2	21.7	33.0	3	2	8.8	33.0	27.0
4	6	9.5	33.0	3	2	8.8	33.0	79.3
4	7	21.4	33.0	3	2	8.8	33.0	78.6
5	3	-20.2	33.0	3	2	8.8	33.0	-56.5
6	4	9.5	33.0	3	2	8.8	33.0	65.2
7	4	21.4	33.0	3	2	8.8	33.0	71.2
7	8	8.1	33.0	3	2	8.8	33.0	102.2
7	9	24.9	33.0	3	2	8.8	33.0	84.2
8	7	-6.9	33.0	3	2	8.8	33.0	83.2
9	7	12.9	33.0	3	2	8.8	33.0	84.6
9	10	5.8	33.0	3	2	8.8	33.0	95.4
9	11	23.8	33.0	3	2	8.8	33.0	66.5
10	9	0.8	33.0	3	2	8.8	33.0	70.2
11	9	8.8	33.0	3	2	8.8	33.0	88.2
11	12	8.1	33.0	3	2	8.8	33.0	75.4
11	13	18.3	33.0	3	2	8.8	33.0	75.1
12	11	8.1	33.0	3	2	8.8	33.0	84.6
13	11	18.3	33.0	3	2	8.8	33.0	95.5
13	14	10.7	33.0	3	2	8.8	33.0	78.0
13	15	21.9	33.0	3	2	8.8	33.0	68.3
14	13	10.7	33.0	3	2	8.8	33.0	81.1
15	13	21.9	33.0	3	2	8.8	33.0	92.1
15	16	0.3	33.0	3	2	8.8	33.0	78.8
15	17	1.1	33.0	3	2	8.8	33.0	75.9
16	15	0.3	33.0	3	2	8.8	33.0	75.3
17	15	1.1	33.0	3	2	8.8	33.0	85.3
18	19	30.0	24.9	3	2	8.8	33.0	94.3
19	18	30.0	24.9	3	2	8.8	33.0	69.0
20	21	30.0	24.9	3	2	8.8	33.0	97.5
21	20	30.0	24.9	3	2	8.8	33.0	94.6
22	23	18.4	24.6	3	2	8.8	33.0	99.2
23	22	18.4	24.6	3	2	8.8	33.0	95.3
24	25	18.4	24.6	3	2	8.8	33.0	100.4
25	24	18.4	24.6	3	2	8.8	33.0	104.3
26	27	18.4	24.6	3	2	8.8	33.0	93.4
27	26	18.4	24.6	3	2	8.8	33.0	93.4
28	29	30.0	25.1	3	2	8.8	33.0	87.2
29	28	30.0	25.1	3	2	8.8	33.0	90.5
30	31	30.0	25.1	3	2	8.8	33.0	90.5
31	30	30.0	25.1	3	2	8.8	33.0	79.4

32	33	18.4	24.6	3	2	8.8	33.0	100.7
33	32	18.4	24.6	3	2	8.8	33.0	62.4
34	35	18.4	24.6	3	2	8.8	33.0	83.7
35	34	18.4	24.6	3	2	8.8	33.0	87.3
1	2	12.4	33.0	3	5	-20.2	33.0	112.0
2	1	12.4	33.0	3	5	-20.2	33.0	107.0
2	3	8.8	33.0	3	5	-20.2	33.0	-12.4
2	4	19.7	33.0	3	5	-20.2	33.0	80.3
3	2	8.8	33.0	3	5	-20.2	33.0	62.0
4	2	21.7	33.0	3	5	-20.2	33.0	89.0
4	6	9.5	33.0	3	5	-20.2	33.0	87.3
4	7	21.4	33.0	3	5	-20.2	33.0	101.6
5	3	-20.2	33.0	3	5	-20.2	33.0	-37.5
6	4	9.5	33.0	3	5	-20.2	33.0	83.2
7	4	21.4	33.0	3	5	-20.2	33.0	89.2
7	8	8.1	33.0	3	5	-20.2	33.0	125.2
7	9	24.9	33.0	3	5	-20.2	33.0	107.2
8	7	-6.9	33.0	3	5	-20.2	33.0	106.2
9	7	12.9	33.0	3	5	-20.2	33.0	107.6
9	10	5.8	33.0	3	5	-20.2	33.0	118.4
9	11	23.8	33.0	3	5	-20.2	33.0	89.5
10	9	0.8	33.0	3	5	-20.2	33.0	93.2
11	9	8.8	33.0	3	5	-20.2	33.0	111.2
11	12	8.1	33.0	3	5	-20.2	33.0	110.4
11	13	18.3	33.0	3	5	-20.2	33.0	110.1
12	11	8.1	33.0	3	5	-20.2	33.0	107.6
13	11	18.3	33.0	3	5	-20.2	33.0	118.5
13	14	10.7	33.0	3	5	-20.2	33.0	113.0
13	15	21.9	33.0	3	5	-20.2	33.0	103.3
14	13	10.7	33.0	3	5	-20.2	33.0	116.1
15	13	21.9	33.0	3	5	-20.2	33.0	127.1
15	16	0.3	33.0	3	5	-20.2	33.0	113.8
15	17	1.1	33.0	3	5	-20.2	33.0	110.9
16	15	0.3	33.0	3	5	-20.2	33.0	110.3
17	15	1.1	33.0	3	5	-20.2	33.0	120.3
18	19	30.0	24.9	3	5	-20.2	33.0	123.3
19	18	30.0	24.9	3	5	-20.2	33.0	98.0
20	21	30.0	24.9	3	5	-20.2	33.0	119.5
21	20	30.0	24.9	3	5	-20.2	33.0	112.6
22	23	18.4	24.6	3	5	-20.2	33.0	138.2
23	22	18.4	24.6	3	5	-20.2	33.0	134.3
24	25	18.4	24.6	3	5	-20.2	33.0	135.4
25	24	18.4	24.6	3	5	-20.2	33.0	139.3
26	27	18.4	24.6	3	5	-20.2	33.0	112.4
27	26	18.4	24.6	3	5	-20.2	33.0	112.4
28	29	30.0	25.1	3	5	-20.2	33.0	116.2
29	28	30.0	25.1	3	5	-20.2	33.0	119.5
30	31	30.0	25.1	3	5	-20.2	33.0	119.5
31	30	30.0	25.1	3	5	-20.2	33.0	101.4
32	33	18.4	24.6	3	5	-20.2	33.0	119.7
33	32	18.4	24.6	3	5	-20.2	33.0	81.4
34	35	18.4	24.6	3	5	-20.2	33.0	122.7
35	34	18.4	24.6	3	5	-20.2	33.0	126.3
1	2	12.4	33.0	4	2	21.7	33.0	45.0
2	1	12.4	33.0	4	2	21.7	33.0	47.1
2	3	8.8	33.0	4	2	21.7	33.0	46.4
X FOR DIST =			0.10000D+01					
X FOR DIST =			0.10000D+01					
2	4	19.7	33.0	4	2	21.7	33.0	55.4
3	2	8.8	33.0	4	2	21.7	33.0	17.0
3	5	-20.2	33.0	4	2	21.7	33.0	32.2
X FOR DIST =			0.10000D+01					
X FOR DIST =			0.10000D+01					
4	6	9.5	33.0	4	2	21.7	33.0	5.8
X FOR DIST =			0.10000D+01					
X FOR DIST =			0.10000D+01					

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  4  7   21.4  33.0       4   2    21.7  33.0            28.7
  5  3  -20.2  33.0       4   2    21.7  33.0            20.3
 X FOR DIST =   0.10000D+01
 X FOR DIST =   0.10000D+01
  6  4    9.5  33.0       4   2    21.7  33.0            58.3
 X FOR DIST =   0.10000D+01
 X FOR DIST =   0.10000D+01
  7  4   21.4  33.0       4   2    21.7  33.0            57.3
  7  8    8.1  33.0       4   2    21.7  33.0            77.4
  7  9   24.9  33.0       4   2    21.7  33.0            52.7
  8  7   -6.9  33.0       4   2    21.7  33.0            66.3
  9  7   12.9  33.0       4   2    21.7  33.0            63.7
  9 10    5.8  33.0       4   2    21.7  33.0            74.2
  9 11   23.8  33.0       4   2    21.7  33.0            66.6
 10  9    0.8  33.0       4   2    21.7  33.0            59.7
 11  9    8.8  33.0       4   2    21.7  33.0            66.7
 11 12    8.1  33.0       4   2    21.7  33.0            59.8
 11 13   18.3  33.0       4   2    21.7  33.0            55.2
 12 11    8.1  33.0       4   2    21.7  33.0            62.7
 13 11   18.3  33.0       4   2    21.7  33.0            73.6
 13 14   10.7  33.0       4   2    21.7  33.0            62.2
 13 15   21.9  33.0       4   2    21.7  33.0            62.0
 14 13   10.7  33.0       4   2    21.7  33.0            65.2
 15 13   21.9  33.0       4   2    21.7  33.0            76.2
 15 16    0.3  33.0       4   2    21.7  33.0            68.4
 15 17    1.1  33.0       4   2    21.7  33.0            52.6
 16 15    0.3  33.0       4   2    21.7  33.0            59.0
 17 15    1.1  33.0       4   2    21.7  33.0            69.0
 18 19   30.0  24.9       4   2    21.7  33.0            82.0
 19 18   30.0  24.9       4   2    21.7  33.0            66.5
 20 21   30.0  24.9       4   2    21.7  33.0            87.8
 21 20   30.0  24.9       4   2    21.7  33.0            80.8
 22 23   18.4  24.6       4   2    21.7  33.0            87.1
 23 22   18.4  24.6       4   2    21.7  33.0            83.1
 24 25   18.4  24.6       4   2    21.7  33.0            83.6
 25 24   18.4  24.6       4   2    21.7  33.0            87.6
 26 27   18.4  24.6       4   2    21.7  33.0            84.2
 27 26   18.4  24.6       4   2    21.7  33.0            80.3
 28 29   30.0  25.1       4   2    21.7  33.0            69.5
 29 28   30.0  25.1       4   2    21.7  33.0            77.8
 30 31   30.0  25.1       4   2    21.7  33.0            67.1
 31 30   30.0  25.1       4   2    21.7  33.0            69.0
 32 33   18.4  24.6       4   2    21.7  33.0            87.4
 33 32   18.4  24.6       4   2    21.7  33.0            61.2
 34 35   18.4  24.6       4   2    21.7  33.0            71.4
 35 34   18.4  24.6       4   2    21.7  33.0            75.1
  1  2   12.4  33.0       4   6     9.5  33.0            75.2
  2  1   12.4  33.0       4   6     9.5  33.0            69.3
  2  3    8.8  33.0       4   6     9.5  33.0            58.6
 X FOR DIST =   0.10000D+01
 X FOR DIST =   0.10000D+01
  2  4   19.7  33.0       4   6     9.5  33.0            67.6
  3  2    8.8  33.0       4   6     9.5  33.0            47.2
  3  5  -20.2  33.0       4   6     9.5  33.0            48.4
 X FOR DIST =   0.10000D+01
 X FOR DIST =   0.10000D+01
  4  2   21.7  33.0       4   6     9.5  33.0            30.2
 X FOR DIST =   0.10000D+01
 X FOR DIST =   0.10000D+01
  4  7   21.4  33.0       4   6     9.5  33.0            40.9
  5  3  -20.2  33.0       4   6     9.5  33.0            32.5
 X FOR DIST =   0.10000D+01
 X FOR DIST =   0.10000D+01
  6  4    9.5  33.0       4   6     9.5  33.0            70.5
 X FOR DIST =   0.10000D+01
 X FOR DIST =   0.10000D+01
```

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 7  4    21.4   33.0      4   6    9.5   33.0        69.5
 7  8     8.1   33.0      4   6    9.5   33.0        89.6
 7  9    24.9   33.0      4   6    9.5   33.0        64.9
 8  7    -6.9   33.0      4   6    9.5   33.0        78.5
 9  7    12.9   33.0      4   6    9.5   33.0        75.9
 9 10     5.8   33.0      4   6    9.5   33.0        86.4
 9 11    23.8   33.0      4   6    9.5   33.0        78.8
10  9     0.8   33.0      4   6    9.5   33.0        71.9
11  9     8.8   33.0      4   6    9.5   33.0        78.9
11 12     8.1   33.0      4   6    9.5   33.0        72.0
11 13    18.3   33.0      4   6    9.5   33.0        67.4
12 11     8.1   33.0      4   6    9.5   33.0        74.9
13 11    18.3   33.0      4   6    9.5   33.0        85.8
13 14    10.7   33.0      4   6    9.5   33.0        74.4
13 15    21.9   33.0      4   6    9.5   33.0        74.2
14 13    10.7   33.0      4   6    9.5   33.0        77.4
15 13    21.9   33.0      4   6    9.5   33.0        88.4
15 16     0.3   33.0      4   6    9.5   33.0        80.6
15 17     1.1   33.0      4   6    9.5   33.0        64.8
16 15     0.3   33.0      4   6    9.5   33.0        71.2
17 15     1.1   33.0      4   6    9.5   33.0        81.2
18 19    30.0   24.9      4   6    9.5   33.0        94.2
19 18    30.0   24.9      4   6    9.5   33.0        78.7
20 21    30.0   24.9      4   6    9.5   33.0       100.0
21 20    30.0   24.9      4   6    9.5   33.0        93.0
22 23    18.4   24.6      4   6    9.5   33.0        99.3
23 22    18.4   24.6      4   6    9.5   33.0        95.3
24 25    18.4   24.6      4   6    9.5   33.0        99.8
25 24    18.4   24.6      4   6    9.5   33.0       103.8
26 27    18.4   24.6      4   6    9.5   33.0        96.4
27 26    18.4   24.6      4   6    9.5   33.0        92.5
28 29    30.0   25.1      4   6    9.5   33.0        81.7
29 28    30.0   25.1      4   6    9.5   33.0        90.0
30 31    30.0   25.1      4   6    9.5   33.0        79.3
31 30    30.0   25.1      4   6    9.5   33.0        81.2
32 33    18.4   24.6      4   6    9.5   33.0        99.6
33 32    18.4   24.6      4   6    9.5   33.0        73.4
34 35    18.4   24.6      4   6    9.5   33.0        83.6
35 34    18.4   24.6      4   6    9.5   33.0        87.3
 1  2    12.4   33.0      4   7   21.4   33.0        74.3
 2  1    12.4   33.0      4   7   21.4   33.0        64.4
 2  3     8.8   33.0      4   7   21.4   33.0        53.7
X FOR DIST =   0.10000D+01
X FOR DIST =   0.10000D+01
 2  4    19.7   33.0      4   7   21.4   33.0        62.7
 3  2     8.8   33.0      4   7   21.4   33.0        46.3
 3  5   -20.2   33.0      4   7   21.4   33.0        43.5
X FOR DIST =   0.10000D+01
X FOR DIST =   0.10000D+01
 4  2    21.7   33.0      4   7   21.4   33.0        29.3
X FOR DIST =   0.10000D+01
X FOR DIST =   0.10000D+01
 4  6     9.5   33.0      4   7   21.4   33.0        17.1
 5  3   -20.2   33.0      4   7   21.4   33.0        27.6
X FOR DIST =   0.10000D+01
X FOR DIST =   0.10000D+01
 6  4     9.5   33.0      4   7   21.4   33.0        65.6
X FOR DIST =   0.10000D+01
X FOR DIST =   0.10000D+01
 7  4    21.4   33.0      4   7   21.4   33.0        64.6
 7  8     8.1   33.0      4   7   21.4   33.0        48.7
 7  9    24.9   33.0      4   7   21.4   33.0        36.0
 8  7    -6.9   33.0      4   7   21.4   33.0        37.6
 9  7    12.9   33.0      4   7   21.4   33.0        35.0
 9 10     5.8   33.0      4   7   21.4   33.0        45.5
 9 11    23.8   33.0      4   7   21.4   33.0        49.9
```

10	9	0.8	33.0	4	7	21.4	33.0	43.0
11	9	8.8	33.0	4	7	21.4	33.0	50.0
11	12	8.1	33.0	4	7	21.4	33.0	31.1
11	13	18.3	33.0	4	7	21.4	33.0	38.5
12	11	8.1	33.0	4	7	21.4	33.0	46.0
13	11	18.3	33.0	4	7	21.4	33.0	56.9
13	14	10.7	33.0	4	7	21.4	33.0	33.5
13	15	21.9	33.0	4	7	21.4	33.0	51.3
14	13	10.7	33.0	4	7	21.4	33.0	48.5
15	13	21.9	33.0	4	7	21.4	33.0	59.5
15	16	0.3	33.0	4	7	21.4	33.0	61.7
15	17	1.1	33.0	4	7	21.4	33.0	41.9
16	15	0.3	33.0	4	7	21.4	33.0	48.3
17	15	1.1	33.0	4	7	21.4	33.0	58.3
18	19	30.0	24.9	4	7	21.4	33.0	86.3
19	18	30.0	24.9	4	7	21.4	33.0	70.8
20	21	30.0	24.9	4	7	21.4	33.0	94.1
21	20	30.0	24.9	4	7	21.4	33.0	87.1
22	23	18.4	24.6	4	7	21.4	33.0	76.4
23	22	18.4	24.6	4	7	21.4	33.0	72.4
24	25	18.4	24.6	4	7	21.4	33.0	76.9
25	24	18.4	24.6	4	7	21.4	33.0	80.9
26	27	18.4	24.6	4	7	21.4	33.0	84.5
27	26	18.4	24.6	4	7	21.4	33.0	80.6
28	29	30.0	25.1	4	7	21.4	33.0	73.8
29	28	30.0	25.1	4	7	21.4	33.0	82.1
30	31	30.0	25.1	4	7	21.4	33.0	77.4
31	30	30.0	25.1	4	7	21.4	33.0	79.3
32	33	18.4	24.6	4	7	21.4	33.0	87.7
33	32	18.4	24.6	4	7	21.4	33.0	61.5
34	35	18.4	24.6	4	7	21.4	33.0	54.7
35	34	18.4	24.6	4	7	21.4	33.0	64.4
1	2	12.4	33.0	5	3	-20.2	33.0	108.9
2	1	12.4	33.0	5	3	-20.2	33.0	98.5
2	3	8.8	33.0	5	3	-20.2	33.0	48.1
2	4	19.7	33.0	5	3	-20.2	33.0	92.2
3	2	8.8	33.0	5	3	-20.2	33.0	70.9
3	5	-20.2	33.0	5	3	-20.2	33.0	-22.2
4	2	21.7	33.0	5	3	-20.2	33.0	85.9
4	6	9.5	33.0	5	3	-20.2	33.0	112.7
4	7	21.4	33.0	5	3	-20.2	33.0	107.9
6	4	9.5	33.0	5	3	-20.2	33.0	99.2
7	4	21.4	33.0	5	3	-20.2	33.0	105.2
7	8	8.1	33.0	5	3	-20.2	33.0	127.5
7	9	24.9	33.0	5	3	-20.2	33.0	99.5
8	7	-6.9	33.0	5	3	-20.2	33.0	112.5
9	7	12.9	33.0	5	3	-20.2	33.0	113.9
9	10	5.8	33.0	5	3	-20.2	33.0	114.7
9	11	23.8	33.0	5	3	-20.2	33.0	85.7
10	9	0.8	33.0	5	3	-20.2	33.0	89.5
11	9	8.8	33.0	5	3	-20.2	33.0	107.4
11	12	8.1	33.0	5	3	-20.2	33.0	100.7
11	13	18.3	33.0	5	3	-20.2	33.0	100.3
12	11	8.1	33.0	5	3	-20.2	33.0	103.8
13	11	18.3	33.0	5	3	-20.2	33.0	114.8
13	14	10.7	33.0	5	3	-20.2	33.0	103.2
13	15	21.9	33.0	5	3	-20.2	33.0	93.4
14	13	10.7	33.0	5	3	-20.2	33.0	106.3
15	13	21.9	33.0	5	3	-20.2	33.0	117.3
15	16	0.3	33.0	5	3	-20.2	33.0	104.0
15	17	1.1	33.0	5	3	-20.2	33.0	101.0
16	15	0.3	33.0	5	3	-20.2	33.0	100.5
17	15	1.1	33.0	5	3	-20.2	33.0	110.4
18	19	30.0	24.9	5	3	-20.2	33.0	127.3
19	18	30.0	24.9	5	3	-20.2	33.0	102.0
20	21	30.0	24.9	5	3	-20.2	33.0	136.3

21	20	30.0	24.9	5	3	-20.2	33.0	129.5
22	23	18.4	24.6	5	3	-20.2	33.0	121.4
23	22	18.4	24.6	5	3	-20.2	33.0	117.4
24	25	18.4	24.6	5	3	-20.2	33.0	125.4
25	24	18.4	24.6	5	3	-20.2	33.0	129.4
26	27	18.4	24.6	5	3	-20.2	33.0	122.4
27	26	18.4	24.6	5	3	-20.2	33.0	122.5
28	29	30.0	25.1	5	3	-20.2	33.0	120.0
29	28	30.0	25.1	5	3	-20.2	33.0	123.3
30	31	30.0	25.1	5	3	-20.2	33.0	123.3
31	30	30.0	25.1	5	3	-20.2	33.0	122.2
32	33	18.4	24.6	5	3	-20.2	33.0	129.7
33	32	18.4	24.6	5	3	-20.2	33.0	91.4
34	35	18.4	24.6	5	3	-20.2	33.0	105.8
35	34	18.4	24.6	5	3	-20.2	33.0	109.4
1	2	12.4	33.0	6	4	9.5	33.0	94.1
2	1	12.4	33.0	6	4	9.5	33.0	84.3
2	3	8.8	33.0	6	4	9.5	33.0	72.6
X FOR DIST =			0.10000D+01					
X FOR DIST =			0.10000D+01					
2	4	19.7	33.0	6	4	9.5	33.0	15.0
3	2	8.8	33.0	6	4	9.5	33.0	66.1
3	5	-20.2	33.0	6	4	9.5	33.0	61.9
X FOR DIST =			0.10000D+01					
X FOR DIST =			0.10000D+01					
4	2	21.7	33.0	6	4	9.5	33.0	49.1
X FOR DIST =			0.10000D+01					
X FOR DIST =			0.10000D+01					
4	6	9.5	33.0	6	4	9.5	33.0	-61.9
X FOR DIST =			0.10000D+01					
X FOR DIST =			0.10000D+01					
4	7	21.4	33.0	6	4	9.5	33.0	68.7
5	3	-20.2	33.0	6	4	9.5	33.0	36.6
X FOR DIST =			0.10000D+01					
X FOR DIST =			0.10000D+01					
7	4	21.4	33.0	6	4	9.5	33.0	28.0
7	8	8.1	33.0	6	4	9.5	33.0	99.4
7	9	24.9	33.0	6	4	9.5	33.0	62.9
8	7	-6.9	33.0	6	4	9.5	33.0	88.4
9	7	12.9	33.0	6	4	9.5	33.0	85.7
9	10	5.8	33.0	6	4	9.5	33.0	96.3
9	11	23.8	33.0	6	4	9.5	33.0	84.8
10	9	0.8	33.0	6	4	9.5	33.0	74.9
11	9	8.8	33.0	6	4	9.5	33.0	88.8
11	12	8.1	33.0	6	4	9.5	33.0	81.9
11	13	18.3	33.0	6	4	9.5	33.0	81.4
12	11	8.1	33.0	6	4	9.5	33.0	84.9
13	11	18.3	33.0	6	4	9.5	33.0	95.9
13	14	10.7	33.0	6	4	9.5	33.0	84.3
13	15	21.9	33.0	6	4	9.5	33.0	80.2
14	13	10.7	33.0	6	4	9.5	33.0	87.4
15	13	21.9	33.0	6	4	9.5	33.0	98.4
15	16	0.3	33.0	6	4	9.5	33.0	84.7
15	17	1.1	33.0	6	4	9.5	33.0	81.8
16	15	0.3	33.0	6	4	9.5	33.0	81.2
17	15	1.1	33.0	6	4	9.5	33.0	91.2
18	19	30.0	24.9	6	4	9.5	33.0	97.7
19	18	30.0	24.9	6	4	9.5	33.0	82.3
20	21	30.0	24.9	6	4	9.5	33.0	96.1
21	20	30.0	24.9	6	4	9.5	33.0	89.1
22	23	18.4	24.6	6	4	9.5	33.0	109.1
23	22	18.4	24.6	6	4	9.5	33.0	105.2
24	25	18.4	24.6	6	4	9.5	33.0	105.9
25	24	18.4	24.6	6	4	9.5	33.0	109.8
26	27	18.4	24.6	6	4	9.5	33.0	82.6
27	26	18.4	24.6	6	4	9.5	33.0	82.7

```
28 29     30.0  25.1         6   4     9.5   33.0              90.7
29 28     30.0  25.1         6   4     9.5   33.0              93.4
30 31     30.0  25.1         6   4     9.5   33.0              93.0
31 30     30.0  25.1         6   4     9.5   33.0              81.2
32 33     18.4  24.6         6   4     9.5   33.0              89.9
33 32     18.4  24.6         6   4     9.5   33.0              63.6
34 35     18.4  24.6         6   4     9.5   33.0              93.5
35 34     18.4  24.6         6   4     9.5   33.0              97.2
 1  2     12.4  33.0         7   4    21.4   33.0              75.1
 2  1     12.4  33.0         7   4    21.4   33.0              73.9
 2  3      8.8  33.0         7   4    21.4   33.0              61.0
X FOR DIST =   0.10000D+01
X FOR DIST =   0.10000D+01
 2  4     19.7  33.0         7   4    21.4   33.0              27.1
 3  2      8.8  33.0         7   4    21.4   33.0              47.1
 3  5    -20.2  33.0         7   4    21.4   33.0              46.3
X FOR DIST =   0.10000D+01
X FOR DIST =   0.10000D+01
 4  2     21.7  33.0         7   4    21.4   33.0              59.1
X FOR DIST =   0.10000D+01
X FOR DIST =   0.10000D+01
 4  6      9.5  33.0         7   4    21.4   33.0              57.8
X FOR DIST =   0.10000D+01
X FOR DIST =   0.10000D+01
 4  7     21.4  33.0         7   4    21.4   33.0             -63.8
 5  3    -20.2  33.0         7   4    21.4   33.0              40.0
X FOR DIST =   0.10000D+01
X FOR DIST =   0.10000D+01
 6  4      9.5  33.0         7   4    21.4   33.0              30.0
 7  8      8.1  33.0         7   4    21.4   33.0              19.7
 7  9     24.9  33.0         7   4    21.4   33.0              42.5
 8  7     -6.9  33.0         7   4    21.4   33.0             -49.2
 9  7     12.9  33.0         7   4    21.4   33.0             -57.8
 9 10      5.8  33.0         7   4    21.4   33.0              74.9
 9 11     23.8  33.0         7   4    21.4   33.0              61.0
10  9      0.8  33.0         7   4    21.4   33.0              54.5
11  9      8.8  33.0         7   4    21.4   33.0              68.5
11 12      8.1  33.0         7   4    21.4   33.0              65.1
11 13     18.3  33.0         7   4    21.4   33.0              61.5
12 11      8.1  33.0         7   4    21.4   33.0              67.1
13 11     18.3  33.0         7   4    21.4   33.0              78.1
13 14     10.7  33.0         7   4    21.4   33.0              69.0
13 15     21.9  33.0         7   4    21.4   33.0              65.6
14 13     10.7  33.0         7   4    21.4   33.0              71.5
15 13     21.9  33.0         7   4    21.4   33.0              82.5
15 16      0.3  33.0         7   4    21.4   33.0              69.9
15 17      1.1  33.0         7   4    21.4   33.0              67.4
16 15      0.3  33.0         7   4    21.4   33.0              66.6
17 15      1.1  33.0         7   4    21.4   33.0              76.6
18 19     30.0  24.9         7   4    21.4   33.0              83.9
19 18     30.0  24.9         7   4    21.4   33.0              58.3
20 21     30.0  24.9         7   4    21.4   33.0              56.7
21 20     30.0  24.9         7   4    21.4   33.0              61.8
22 23     18.4  24.6         7   4    21.4   33.0              95.9
23 22     18.4  24.6         7   4    21.4   33.0              92.0
24 25     18.4  24.6         7   4    21.4   33.0              92.9
25 24     18.4  24.6         7   4    21.4   33.0              96.9
26 27     18.4  24.6         7   4    21.4   33.0              73.5
27 26     18.4  24.6         7   4    21.4   33.0              73.6
28 29     30.0  25.1         7   4    21.4   33.0              78.5
29 28     30.0  25.1         7   4    21.4   33.0              80.7
30 31     30.0  25.1         7   4    21.4   33.0              73.1
31 30     30.0  25.1         7   4    21.4   33.0              56.0
32 33     18.4  24.6         7   4    21.4   33.0              80.8
33 32     18.4  24.6         7   4    21.4   33.0              42.6
34 35     18.4  24.6         7   4    21.4   33.0              80.4
```

35	34	18.4	24.6	7	4	21.4	33.0	84.0
1	2	12.4	33.0	7	8	8.1	33.0	88.4
2	1	12.4	33.0	7	8	8.1	33.0	87.2
2	3	8.8	33.0	7	8	8.1	33.0	74.3
2	4	19.7	33.0	7	8	8.1	33.0	73.4
3	2	8.8	33.0	7	8	8.1	33.0	60.4
3	5	-20.2	33.0	7	8	8.1	33.0	59.6
4	2	21.7	33.0	7	8	8.1	33.0	72.4
4	6	9.5	33.0	7	8	8.1	33.0	86.1
4	7	21.4	33.0	7	8	8.1	33.0	-40.5
5	3	-20.2	33.0	7	8	8.1	33.0	53.3
6	4	9.5	33.0	7	8	8.1	33.0	76.3
7	4	21.4	33.0	7	8	8.1	33.0	46.3
7	9	24.9	33.0	7	8	8.1	33.0	45.8
8	7	-6.9	33.0	7	8	8.1	33.0	-25.9
9	7	12.9	33.0	7	8	8.1	33.0	-34.5
9	10	5.8	33.0	7	8	8.1	33.0	78.2
9	11	23.8	33.0	7	8	8.1	33.0	64.3
10	9	0.8	33.0	7	8	8.1	33.0	57.8
11	9	8.8	33.0	7	8	8.1	33.0	71.8
11	12	8.1	33.0	7	8	8.1	33.0	68.4
11	13	18.3	33.0	7	8	8.1	33.0	64.8
12	11	8.1	33.0	7	8	8.1	33.0	70.4
13	11	18.3	33.0	7	8	8.1	33.0	81.4
13	14	10.7	33.0	7	8	8.1	33.0	72.3
13	15	21.9	33.0	7	8	8.1	33.0	68.9
14	13	10.7	33.0	7	8	8.1	33.0	74.8
15	13	21.9	33.0	7	8	8.1	33.0	85.8
15	16	0.3	33.0	7	8	8.1	33.0	73.2
15	17	1.1	33.0	7	8	8.1	33.0	70.7
16	15	0.3	33.0	7	8	8.1	33.0	69.9
17	15	1.1	33.0	7	8	8.1	33.0	79.9
18	19	30.0	24.9	7	8	8.1	33.0	97.2
19	18	30.0	24.9	7	8	8.1	33.0	71.6
20	21	30.0	24.9	7	8	8.1	33.0	103.0
21	20	30.0	24.9	7	8	8.1	33.0	96.1
22	23	18.4	24.6	7	8	8.1	33.0	99.2
23	22	18.4	24.6	7	8	8.1	33.0	95.3
24	25	18.4	24.6	7	8	8.1	33.0	96.2
25	24	18.4	24.6	7	8	8.1	33.0	100.2
26	27	18.4	24.6	7	8	8.1	33.0	92.8
27	26	18.4	24.6	7	8	8.1	33.0	92.9
28	29	30.0	25.1	7	8	8.1	33.0	91.8
29	28	30.0	25.1	7	8	8.1	33.0	94.0
30	31	30.0	25.1	7	8	8.1	33.0	93.4
31	30	30.0	25.1	7	8	8.1	33.0	90.3
32	33	18.4	24.6	7	8	8.1	33.0	100.1
33	32	18.4	24.6	7	8	8.1	33.0	61.9
34	35	18.4	24.6	7	8	8.1	33.0	83.7
35	34	18.4	24.6	7	8	8.1	33.0	87.3
1	2	12.4	33.0	7	9	24.9	33.0	75.6
2	1	12.4	33.0	7	9	24.9	33.0	74.4
2	3	8.8	33.0	7	9	24.9	33.0	67.5
2	4	19.7	33.0	7	9	24.9	33.0	62.6
3	2	8.8	33.0	7	9	24.9	33.0	47.6
3	5	-20.2	33.0	7	9	24.9	33.0	52.8
4	2	21.7	33.0	7	9	24.9	33.0	59.6
4	6	9.5	33.0	7	9	24.9	33.0	75.3
4	7	21.4	33.0	7	9	24.9	33.0	-57.3
5	3	-20.2	33.0	7	9	24.9	33.0	46.5
6	4	9.5	33.0	7	9	24.9	33.0	65.5
7	4	21.4	33.0	7	9	24.9	33.0	35.5
7	8	8.1	33.0	7	9	24.9	33.0	12.2
8	7	-6.9	33.0	7	9	24.9	33.0	-42.7
9	7	12.9	33.0	7	9	24.9	33.0	-51.3
9	10	5.8	33.0	7	9	24.9	33.0	44.4

9	11	23.8	33.0	7	9	24.9	33.0	30.5
10	9	0.8	33.0	7	9	24.9	33.0	12.0
11	9	8.8	33.0	7	.9	24.9	33.0	26.0
11	12	8.1	33.0	7	9	24.9	33.0	34.6
11	13	18.3	33.0	7	9	24.9	33.0	19.0
12	11	8.1	33.0	7	9	24.9	33.0	36.6
13	11	18.3	33.0	7	9	24.9	33.0	47.6
13	14	10.7	33.0	7	9	24.9	33.0	48.5
13	15	21.9	33.0	7	9	24.9	33.0	23.1
14	13	10.7	33.0	7	9	24.9	33.0	29.0
15	13	21.9	33.0	7	9	24.9	33.0	40.0
15	16	0.3	33.0	7	9	24.9	33.0	39.4
15	17	1.1	33.0	7	9	24.9	33.0	24.9
16	15	0.3	33.0	7	9	24.9	33.0	24.1
17	15	1.1	33.0	7	9	24.9	33.0	34.1
18	19	30.0	24.9	7	9	24.9	33.0	90.4
19	18	30.0	24.9	7	9	24.9	33.0	64.8
20	21	30.0	24.9	7	9	24.9	33.0	92.2
21	20	30.0	24.9	7	9	24.9	33.0	85.3
22	23	18.4	24.6	7	9	24.9	33.0	75.4
23	22	18.4	24.6	7	9	24.9	33.0	71.5
24	25	18.4	24.6	7	9	24.9	33.0	68.4
25	24	18.4	24.6	7	9	24.9	33.0	72.4
26	27	18.4	24.6	7	9	24.9	33.0	76.0
27	26	18.4	24.6	7	9	24.9	33.0	76.1
28	29	30.0	25.1	7	9	24.9	33.0	85.0
29	28	30.0	25.1	7	9	24.9	33.0	87.2
30	31	30.0	25.1	7	9	24.9	33.0	86.6
31	30	30.0	25.1	7	9	24.9	33.0	79.5
32	33	18.4	24.6	7	9	24.9	33.0	83.3
33	32	18.4	24.6	7	9	24.9	33.0	45.1
34	35	18.4	24.6	7	9	24.9	33.0	59.9
35	34	18.4	24.6	7	9	24.9	33.0	63.5
1	2	12.4	33.0	8	7	-6.9	33.0	107.3
2	1	12.4	33.0	8	7	-6.9	33.0	106.1
2	3	8.8	33.0	8	7	-6.9	33.0	93.3
2	4	19.7	33.0	8	7	-6.9	33.0	84.4
3	2	8.8	33.0	8	7	-6.9	33.0	86.3
3	5	-20.2	33.0	8	7	-6.9	33.0	74.5
4	2	21.7	33.0	8	7	-6.9	33.0	91.3
4	6	9.5	33.0	8	7	-6.9	33.0	97.2
4	7	21.4	33.0	8	7	-6.9	33.0	28.4
5	3	-20.2	33.0	8	7	-6.9	33.0	72.2
6	4	9.5	33.0	8	7	-6.9	33.0	87.4
7	4	21.4	33.0	8	7	-6.9	33.0	57.4
7	8	8.1	33.0	8	7	-6.9	33.0	-73.9
7	9	24.9	33.0	8	7	-6.9	33.0	70.7
9	7	12.9	33.0	8	7	-6.9	33.0	20.4
9	10	5.8	33.0	8	7	-6.9	33.0	103.1
9	11	23.8	33.0	8	7	-6.9	33.0	89.3
10	9	0.8	33.0	8	7	-6.9	33.0	82.7
11	9	8.8	33.0	8	7	-6.9	33.0	96.7
11	12	8.1	33.0	8	7	-6.9	33.0	93.3
11	13	18.3	33.0	8	7	-6.9	33.0	89.7
12	11	8.1	33.0	8	7	-6.9	33.0	95.4
13	11	18.3	33.0	8	7	-6.9	33.0	106.3
13	14	10.7	33.0	8	7	-6.9	33.0	97.3
13	15	21.9	33.0	8	7	-6.9	33.0	93.9
14	13	10.7	33.0	8	7	-6.9	33.0	99.7
15	13	21.9	33.0	8	7	-6.9	33.0	110.7
15	16	0.3	33.0	8	7	-6.9	33.0	98.2
15	17	1.1	33.0	8	7	-6.9	33.0	95.7
16	15	0.3	33.0	8	7	-6.9	33.0	94.9
17	15	1.1	33.0	8	7	-6.9	33.0	104.9
18	19	30.0	24.9	8	7	-6.9	33.0	116.2
19	18	30.0	24.9	8	7	-6.9	33.0	90.5

20	21	30.0	24.9	8	7	-6.9	33.0	114.0
21	20	30.0	24.9	8	7	-6.9	33.0	107.2
22	23	18.4	24.6	8	7	-6.9	33.0	124.2
23	22	18.4	24.6	8	7	-6.9	33.0	120.2
24	25	18.4	24.6	8	7	-6.9	33.0	121.2
25	24	18.4	24.6	8	7	-6.9	33.0	125.2
26	27	18.4	24.6	8	7	-6.9	33.0	97.8
27	26	18.4	24.6	8	7	-6.9	33.0	97.9
28	29	30.0	25.1	8	7	-6.9	33.0	110.8
29	28	30.0	25.1	8	7	-6.9	33.0	109.0
30	31	30.0	25.1	8	7	-6.9	33.0	108.5
31	30	30.0	25.1	8	7	-6.9	33.0	101.3
32	33	18.4	24.6	8	.7	-6.9	33.0	105.1
33	32	18.4	24.6	8	7	-6.9	33.0	66.9
34	35	18.4	24.6	8	7	-6.9	33.0	108.7
35	34	18.4	24.6	8	7	-6.9	33.0	112.3
1	2	12.4	33.0	9	7	12.9	33.0	79.7
2	1	12.4	33.0	9	7	12.9	33.0	85.7
2	3	8.8	33.0	9	7	12.9	33.0	67.1
2	4	19.7	33.0	9	7	12.9	33.0	51.5
3	2	8.8	33.0	9	7	12.9	33.0	58.7
3	5	-20.2	33.0	9	7	12.9	33.0	38.3
4	2	21.7	33.0	9	7	12.9	33.0	63.7
4	6	9.5	33.0	9	7	12.9	33.0	52.4
4	7	21.4	33.0	9	7	12.9	33.0	43.0
5	3	-20.2	33.0	9	7	12.9	33.0	46.1
6	4	9.5	33.0	9	7	12.9	33.0	54.5
7	4	21.4	33.0	9	7	12.9	33.0	36.5
7	8	8.1	33.0	9	7	12.9	33.0	62.5
7	9	24.9	33.0	9	7	12.9	33.0	-47.3
8	7	-6.9	33.0	9	7	12.9	33.0	37.6
9	10	5.8	33.0	9	7	12.9	33.0	14.9
9	11	23.8	33.0	9	7	12.9	33.0	49.9
10	9	0.8	33.0	9	7	12.9	33.0	-53.3
11	9	8.8	33.0	9	7	12.9	33.0	-50.3
11	12	8.1	33.0	9	7	12.9	33.0	68.2
11	13	18.3	33.0	9	7	12.9	33.0	66.2
12	11	8.1	33.0	9	7	12.9	33.0	68.0
13	11	18.3	33.0	9	7	12.9	33.0	78.9
13	14	10.7	33.0	9	7	12.9	33.0	74.7
13	15	21.9	33.0	9	7	12.9	33.0	71.9
14	13	10.7	33.0	9	7	12.9	33.0	76.1
15	13	21.9	33.0	9	7	12.9	33.0	87.2
15	16	0.3	33.0	9	7	12.9	33.0	76.1
15	17	1.1	33.0	9	7	12.9	33.0	73.9
16	15	0.3	33.0	9	7	12.9	33.0	72.9
17	15	1.1	33.0	9	7	12.9	33.0	82.9
18	19	30.0	24.9	9	7	12.9	33.0	86.6
19	18	30.0	24.9	9	7	12.9	33.0	48.8
20	21	30.0	24.9	9	7	12.9	33.0	84.0
21	20	30.0	24.9	9	7	12.9	33.0	81.2
22	23	18.4	24.6	9	7	12.9	33.0	103.5
23	22	18.4	24.6	9	7	12.9	33.0	99.6
24	25	18.4	24.6	9	7	12.9	33.0	100.7
25	24	18.4	24.6	9	7	12.9	33.0	104.6
26	27	18.4	24.6	9	7	12.9	33.0	81.3
27	26	18.4	24.6	9	7	12.9	33.0	81.3
28	29	30.0	25.1	9	7	12.9	33.0	81.9
29	28	30.0	25.1	9	7	12.9	33.0	83.8
30	31	30.0	25.1	9	7	12.9	33.0	73.1
31	30	30.0	25.1	9	7	12.9	33.0	54.1
32	33	18.4	24.6	9	7	12.9	33.0	88.6
33	32	18.4	24.6	9	7	12.9	33.0	62.4
34	35	18.4	24.6	9	7	12.9	33.0	88.1
35	34	18.4	24.6	9	7	12.9	33.0	91.7
1	2	12.4	33.0	9	10	5.8	33.0	64.8

2	1	12.4	33.0	9	10	5.8	33.0	63.8
2	3	8.8	33.0	9	10	5.8	33.0	70.2
2	4	19.7	33.0	9	10	5.8	33.0	75.6
3	2	8.8	33.0	9	10	5.8	33.0	43.8
3	5	-20.2	33.0	9	10	5.8	33.0	45.4
4	2	21.7	33.0	9	10	5.8	33.0	48.8
4	6	9.5	33.0	9	10	5.8	33.0	81.5
4	7	21.4	33.0	9	10	5.8	33.0	72.1
5	3	-20.2	33.0	9	10	5.8	33.0	49.2
6	4	9.5	33.0	9	10	5.8	33.0	78.6
7	4	21.4	33.0	9	10	5.8	33.0	60.6
7	8	8.1	33.0	9	10	5.8	33.0	91.6
7	9	24.9	33.0	9	10	5.8	33.0	-36.2
8	7	-6.9	33.0	9	10	5.8	33.0	66.7
9	7	12.9	33.0	9	10	5.8	33.0	29.1
9	11	23.8	33.0	9	10	5.8	33.0	57.0
10	9	0.8	33.0	9	10	5.8	33.0	-42.2
11	9	8.8	33.0	9	10	5.8	33.0	-39.2
11	12	8.1	33.0	9	10	5.8	33.0	69.3
11	13	18.3	33.0	9	10	5.8	33.0	73.3
12	11	8.1	33.0	9	10	5.8	33.0	75.1
13	11	18.3	33.0	9	10	5.8	33.0	86.0
13	14	10.7	33.0	9	10	5.8	33.0	75.8
13	15	21.9	33.0	9	10	5.8	33.0	79.0
14	13	10.7	33.0	9	10	5.8	33.0	83.2
15	13	21.9	33.0	9	10	5.8	33.0	94.3
15	16	0.3	33.0	9	10	5.8	33.0	83.2
15	17	1.1	33.0	9	10	5.8	33.0	81.0
16	15	0.3	33.0	9	10	5.8	33.0	80.0
17	15	1.1	33.0	9	10	5.8	33.0	90.0
18	19	30.0	24.9	9	10	5.8	33.0	71.7
19	18	30.0	24.9	9	10	5.8	33.0	33.9
20	21	30.0	24.9	9	10	5.8	33.0	102.1
21	20	30.0	24.9	9	10	5.8	33.0	95.3
22	23	18.4	24.6	9	10	5.8	33.0	104.6
23	22	18.4	24.6	9	10	5.8	33.0	100.7
24	25	18.4	24.6	9	10	5.8	33.0	107.8
25	24	18.4	24.6	9	10	5.8	33.0	111.7
26	27	18.4	24.6	9	10	5.8	33.0	94.4
27	26	18.4	24.6	9	10	5.8	33.0	94.4
28	29	30.0	25.1	9	10	5.8	33.0	67.0
29	28	30.0	25.1	9	10	5.8	33.0	80.9
30	31	30.0	25.1	9	10	5.8	33.0	90.2
31	30	30.0	25.1	9	10	5.8	33.0	90.2
32	33	18.4	24.6	9	10	5.8	33.0	101.7
33	32	18.4	24.6	9	10	5.8	33.0	75.5
34	35	18.4	24.6	9	10	5.8	33.0	89.2
35	34	18.4	24.6	9	10	5.8	33.0	92.8
1	2	12.4	33.0	9	11	23.8	33.0	85.8
2	1	12.4	33.0	9	11	23.8	33.0	84.8
2	3	8.8	33.0	9	11	23.8	33.0	73.2
2	4	19.7	33.0	9	11	23.8	33.0	67.6
3	2	8.8	33.0	9	11	23.8	33.0	64.8
3	5	-20.2	33.0	9	11	23.8	33.0	48.4
4	2	21.7	33.0	9	11	23.8	33.0	69.8
4	6	9.5	33.0	9	11	23.8	33.0	80.5
4	7	21.4	33.0	9	11	23.8	33.0	71.1
5	3	-20.2	33.0	9	11	23.8	33.0	52.2
6	4	9.5	33.0	9	11	23.8	33.0	70.6
7	4	21.4	33.0	9	11	23.8	33.0	52.6
7	8	8.1	33.0	9	11	23.8	33.0	90.6
7	9	24.9	33.0	9	11	23.8	33.0	-48.2
8	7	-6.9	33.0	9	11	23.8	33.0	65.7
9	7	12.9	33.0	9	11	23.8	33.0	28.1
9	10	5.8	33.0	9	11	23.8	33.0	21.0
10	9	0.8	33.0	9	11	23.8	33.0	-54.2

11	9	8.8	33.0	9	11	23.8	33.0	-51.2
11	12	8.1	33.0	9	11	23.8	33.0	47.3
11	13	18.3	33.0	9	11	23.8	33.0	38.3
12	11	8.1	33.0	9	11	23.8	33.0	18.1
13	11	18.3	33.0	9	11	23.8	33.0	29.0
13	14	10.7	33.0	9	11	23.8	33.0	53.8
13	15	21.9	33.0	9	11	23.8	33.0	34.0
14	13	10.7	33.0	9	11	23.8	33.0	48.2
15	13	21.9	33.0	9	11	23.8	33.0	59.3
15	16	0.3	33.0	9	11	23.8	33.0	26.2
15	17	1.1	33.0	9	11	23.8	33.0	42.0
16	15	0.3	33.0	9	11	23.8	33.0	35.0
17	15	1.1	33.0	9	11	23.8	33.0	45.0
18	19	30.0	24.9	9	11	23.8	33.0	92.7
19	18	30.0	24.9	9	11	23.8	33.0	54.9
20	21	30.0	24.9	9	11	23.8	33.0	94.1
21	20	30.0	24.9	9	11	23.8	33.0	87.3
22	23	18.4	24.6	9	11	23.8	33.0	82.6
23	22	18.4	24.6	9	11	23.8	33.0	78.7
24	25	18.4	24.6	9	11	23.8	33.0	50.8
25	24	18.4	24.6	9	11	23.8	33.0	54.7
26	27	18.4	24.6	9	11	23.8	33.0	76.4
27	26	18.4	24.6	9	11	23.8	33.0	76.4
28	29	30.0	25.1	9	11	23.8	33.0	88.0
29	28	30.0	25.1	9	11	23.8	33.0	89.9
30	31	30.0	25.1	9	11	23.8	33.0	89.2
31	30	30.0	25.1	9	11	23.8	33.0	82.2
32	33	18.4	24.6	9	11	23.8	33.0	83.7
33	32	18.4	24.6	9	11	23.8	33.0	57.5
34	35	18.4	24.6	9	11	23.8	33.0	67.2
35	34	18.4	24.6	9	11	23.8	33.0	70.8
1	2	12.4	33.0	10	9	0.8	33.0	108.1
2	1	12.4	33.0	10	9	0.8	33.0	107.1
2	3	8.8	33.0	10	9	0.8	33.0	95.4
2	4	19.7	33.0	10	9	0.8	33.0	90.1
3	2	8.8	33.0	10	9	0.8	33.0	87.1
3	5	-20.2	33.0	10	9	0.8	33.0	70.7
4	2	21.7	33.0	10	9	0.8	33.0	92.1
4	6	9.5	33.0	10	9	0.8	33.0	103.0
4	7	21.4	33.0	10	9	0.8	33.0	92.5
5	3	-20.2	33.0	10	9	0.8	33.0	74.4
6	4	9.5	33.0	10	9	0.8	33.0	93.1
7	4	21.4	33.0	10	9	0.8	33.0	63.1
7	8	8.1	33.0	10	9	0.8	33.0	112.0
7	9	24.9	33.0	10	9	0.8	33.0	32.0
8	7	-6.9	33.0	10	9	0.8	33.0	87.1
9	7	12.9	33.0	10	9	0.8	33.0	61.5
9	10	5.8	33.0	10	9	0.8	33.0	-40.2
9	11	23.8	33.0	10	9	0.8	33.0	43.1
11	9	8.8	33.0	10	9	0.8	33.0	36.0
11	12	8.1	33.0	10	9	0.8	33.0	81.3
11	13	18.3	33.0	10	9	0.8	33.0	79.0
12	11	8.1	33.0	10	9	0.8	33.0	61.2
13	11	18.3	33.0	10	9	0.8	33.0	72.1
13	14	10.7	33.0	10	9	0.8	33.0	87.2
13	15	21.9	33.0	10	9	0.8	33.0	84.5
14	13	10.7	33.0	10	9	0.8	33.0	89.0
15	13	21.9	33.0	10	9	0.8	33.0	100.0
15	16	0.3	33.0	10	9	0.8	33.0	88.7
15	17	1.1	33.0	10	9	0.8	33.0	86.4
16	15	0.3	33.0	10	9	0.8	33.0	85.5
17	15	1.1	33.0	10	9	0.8	33.0	95.5
18	19	30.0	24.9	10	9	0.8	33.0	115.4
19	18	30.0	24.9	10	9	0.8	33.0	77.7
20	21	30.0	24.9	10	9	0.8	33.0	111.0
21	20	30.0	24.9	10	9	0.8	33.0	104.2

22	23	18.4	24.6	10	9	0.8	33.0	115.7
23	22	18.4	24.6	10	9	0.8	33.0	111.8
24	25	18.4	24.6	10	9	0.8	33.0	113.0
25	24	18.4	24.6	10	9	0.8	33.0	116.9
26	27	18.4	24.6	10	9	0.8	33.0	82.6
27	26	18.4	24.6	10	9	0.8	33.0	82.6
28	29	30.0	25.1	10	9	0.8	33.0	110.6
29	28	30.0	25.1	10	9	0.8	33.0	112.6
30	31	30.0	25.1	10	9	0.8	33.0	111.9
31	30	30.0	25.1	10	9	0.8	33.0	105.0
32	33	18.4	24.6	10	9	0.8	33.0	89.9
33	32	18.4	24.6	10	9	0.8	33.0	63.7
34	35	18.4	24.6	10	9	0.8	33.0	100.3
35	34	18.4	24.6	10	9	0.8	33.0	103.9
1	2	12.4	33.0	11	9	8.8	33.0	81.7
2	1	12.4	33.0	11	9	8.8	33.0	80.9
2	3	8.8	33.0	11	9	8.8	33.0	51.6
2	4	19.7	33.0	11	9	8.8	33.0	67.6
3	2	8.8	33.0	11	9	8.8	33.0	60.7
3	5	-20.2	33.0	11	9	8.8	33.0	26.7
4	2	21.7	33.0	11	9	8.8	33.0	65.7
4	6	9.5	33.0	11	9	8.8	33.0	76.5
4	7	21.4	33.0	11	9	8.8	33.0	63.6
5	3	-20.2	33.0	11	9	8.8	33.0	30.5
6	4	9.5	33.0	11	9	8.8	33.0	70.5
7	4	21.4	33.0	11	9	8.8	33.0	52.5
7	8	8.1	33.0	11	9	8.8	33.0	83.3
7	9	24.9	33.0	11	9	8.8	33.0	52.0
8	7	-6.9	33.0	11	9	8.8	33.0	58.3
9	7	12.9	33.0	11	9	8.8	33.0	32.7
9	10	5.8	33.0	11	9	8.8	33.0	28.1
9	11	23.8	33.0	11	9	8.8	33.0	-35.2
10	9	0.8	33.0	11	9	8.8	33.0	42.0
11	12	8.1	33.0	11	9	8.8	33.0	32.3
11	13	18.3	33.0	11	9	8.8	33.0	48.5
12	11	8.1	33.0	11	9	8.8	33.0	-40.1
13	11	18.3	33.0	11	9	8.8	33.0	-35.2
13	14	10.7	33.0	11	9	8.8	33.0	63.7
13	15	21.9	33.0	11	9	8.8	33.0	74.1
14	13	10.7	33.0	11	9	8.8	33.0	76.5
15	13	21.9	33.0	11	9	8.8	33.0	87.5
15	16	0.3	33.0	11	9	8.8	33.0	78.0
15	17	1.1	33.0	11	9	8.8	33.0	69.4
16	15	0.3	33.0	11	9	8.8	33.0	75.1
17	15	1.1	33.0	11	9	8.8	33.0	85.1
18	19	30.0	24.9	11	9	8.8	33.0	87.5
19	18	30.0	24.9	11	9	8.8	33.0	49.6
20	21	30.0	24.9	11	9	8.8	33.0	92.6
21	20	30.0	24.9	11	9	8.8	33.0	85.8
22	23	18.4	24.6	11	9	8.8	33.0	101.1
23	22	18.4	24.6	11	9	8.8	33.0	97.1
24	25	18.4	24.6	11	9	8.8	33.0	104.3
25	24	18.4	24.6	11	9	8.8	33.0	108.2
26	27	18.4	24.6	11	9	8.8	33.0	90.7
27	26	18.4	24.6	11	9	8.8	33.0	90.7
28	29	30.0	25.1	11	9	8.8	33.0	77.2
29	28	30.0	25.1	11	9	8.8	33.0	66.9
30	31	30.0	25.1	11	9	8.8	33.0	66.1
31	30	30.0	25.1	11	9	8.8	33.0	81.2
32	33	18.4	24.6	11	9	8.8	33.0	92.0
33	32	18.4	24.6	11	9	8.8	33.0	66.0
34	35	18.4	24.6	11	9	8.8	33.0	85.7
35	34	18.4	24.6	11	9	8.8	33.0	89.3
1	2	12.4	33.0	11	12	8.1	33.0	97.4
2	1	12.4	33.0	11	12	8.1	33.0	96.6
2	3	8.8	33.0	11	12	8.1	33.0	85.3

2	4	19.7	33.0	11	12	8.1	33.0	79.3
3	2	8.8	33.0	11	12	8.1	33.0	76.4
3	5	-20.2	33.0	11	12	8.1	33.0	60.4
4	2	21.7	33.0	11	12	8.1	33.0	81.4
4	6	9.5	33.0	11	12	8.1	33.0	92.2
4	7	21.4	33.0	11	12	8.1	33.0	85.3
5	3	-20.2	33.0	11	12	8.1	33.0	64.2
6	4	9.5	33.0	11	12	8.1	33.0	82.2
7	4	21.4	33.0	11	12	8.1	33.0	64.2
7	8	8.1	33.0	11	12	8.1	33.0	105.0
7	9	24.9	33.0	11	12	8.1	33.0	85.7
8	7	-6.9	33.0	11	12	8.1	33.0	80.0
9	7	12.9	33.0	11	12	8.1	33.0	54.4
9	10	5.8	33.0	11	12	8.1	33.0	61.8
9	11	23.8	33.0	11	12	8.1	33.0	-24.5
10	9	0.8	33.0	11	12	8.1	33.0	75.7
11	9	8.8	33.0	11	12	8.1	33.0	33.7
11	13	18.3	33.0	11	12	8.1	33.0	39.2
12	11	8.1	33.0	11	12	8.1	33.0	-29.4
13	11	18.3	33.0	11	12	8.1	33.0	-24.5
13	14	10.7	33.0	11	12	8.1	33.0	49.4
13	15	21.9	33.0	11	12	8.1	33.0	64.8
14	13	10.7	33.0	11	12	8.1	33.0	67.2
15	13	21.9	33.0	11	12	8.1	33.0	78.2
15	16	0.3	33.0	11	12	8.1	33.0	68.7
15	17	1.1	33.0	11	12	8.1	33.0	60.1
16	15	0.3	33.0	11	12	8.1	33.0	65.8
17	15	1.1	33.0	11	12	8.1	33.0	75.8
18	19	30.0	24.9	11	12	8.1	33.0	103.2
19	18	30.0	24.9	11	12	8.1	33.0	65.3
20	21	30.0	24.9	11	12	8.1	33.0	104.3
21	20	30.0	24.9	11	12	8.1	33.0	103.5
22	23	18.4	24.6	11	12	8.1	33.0	90.8
23	22	18.4	24.6	11	12	8.1	33.0	86.8
24	25	18.4	24.6	11	12	8.1	33.0	95.0
25	24	18.4	24.6	11	12	8.1	33.0	98.9
26	27	18.4	24.6	11	12	8.1	33.0	91.4
27	26	18.4	24.6	11	12	8.1	33.0	91.4
28	29	30.0	25.1	11	12	8.1	33.0	98.9
29	28	30.0	25.1	11	12	8.1	33.0	100.6
30	31	30.0	25.1	11	12	8.1	33.0	99.8
31	30	30.0	25.1	11	12	8.1	33.0	92.9
32	33	18.4	24.6	11	12	8.1	33.0	98.7
33	32	18.4	24.6	11	12	8.1	33.0	72.7
34	35	18.4	24.6	11	12	8.1	33.0	75.4
35	34	18.4	24.6	11	12	8.1	33.0	79.0
1	2	12.4	33.0	11	13	18.3	33.0	87.2
2	1	12.4	33.0	11	13	18.3	33.0	86.4
2	3	8.8	33.0	11	13	18.3	33.0	81.1
2	4	19.7	33.0	11	13	18.3	33.0	75.1
3	2	8.8	33.0	11	13	18.3	33.0	66.2
3	5	-20.2	33.0	11	13	18.3	33.0	56.2
4	2	21.7	33.0	11	13	18.3	33.0	71.2
4	6	9.5	33.0	11	13	18.3	33.0	88.0
4	7	21.4	33.0	11	13	18.3	33.0	81.1
5	3	-20.2	33.0	11	13	18.3	33.0	60.0
6	4	9.5	33.0	11	13	18.3	33.0	78.0
7	4	21.4	33.0	11	13	18.3	33.0	60.0
7	8	8.1	33.0	11	13	18.3	33.0	100.8
7	9	24.9	33.0	11	13	18.3	33.0	81.5
8	7	-6.9	33.0	11	13	18.3	33.0	75.8
9	7	12.9	33.0	11	13	18.3	33.0	50.2
9	10	5.8	33.0	11	13	18.3	33.0	57.6
9	11	23.8	33.0	11	13	18.3	33.0	-34.7
10	9	0.8	33.0	11	13	18.3	33.0	71.5
11	9	8.8	33.0	11	13	18.3	33.0	29.5

11	12	8.1	33.0	11	13	18.3	33.0	18.8
12	11	8.1	33.0	11	13	18.3	33.0	-39.6
13	11	18.3	33.0	11	13	18.3	33.0	-34.7
13	14	10.7	33.0	11	13	18.3	33.0	43.2
13	15	21.9	33.0	11	13	18.3	33.0	47.6
14	13	10.7	33.0	11	13	18.3	33.0	28.0
15	13	21.9	33.0	11	13	18.3	33.0	39.0
15	16	0.3	33.0	11	13	18.3	33.0	51.5
15	17	1.1	33.0	11	13	18.3	33.0	42.9
16	15	0.3	33.0	11	13	18.3	33.0	48.6
17	15	1.1	33.0	11	13	18.3	33.0	58.6
18	19	30.0	24.9	11	13	18.3	33.0	93.0
19	18	30.0	24.9	11	13	18.3	33.0	55.1
20	21	30.0	24.9	11	13	18.3	33.0	100.1
21	20	30.0	24.9	11	13	18.3	33.0	93.3
22	23	18.4	24.6	11	13	18.3	33.0	80.6
23	22	18.4	24.6	11	13	18.3	33.0	76.6
24	25	18.4	24.6	11	13	18.3	33.0	84.8
25	24	18.4	24.6	11	13	18.3	33.0	88.7
26	27	18.4	24.6	11	13	18.3	33.0	81.2
27	26	18.4	24.6	11	13	18.3	33.0	81.2
28	29	30.0	25.1	11	13	18.3	33.0	88.7
29	28	30.0	25.1	11	13	18.3	33.0	96.4
30	31	30.0	25.1	11	13	18.3	33.0	95.6
31	30	30.0	25.1	11	13	18.3	33.0	88.7
32	33	18.4	24.6	11	13	18.3	33.0	88.5
33	32	18.4	24.6	11	13	18.3	33.0	62.5
34	35	18.4	24.6	11	13	18.3	33.0	61.2
35	34	18.4	24.6	11	13	18.3	33.0	68.8
1	2	12.4	33.0	12	11	8.1	33.0	93.9
2	1	12.4	33.0	12	11	8.1	33.0	93.2
2	3	8.8	33.0	12	11	8.1	33.0	76.1
2	4	19.7	33.0	12	11	8.1	33.0	76.4
3	2	8.8	33.0	12	11	8.1	33.0	72.9
3	5	-20.2	33.0	12	11	8.1	33.0	57.3
4	2	21.7	33.0	12	11	8.1	33.0	77.9
4	6	9.5	33.0	12	11	8.1	33.0	89.3
4	7	21.4	33.0	12	11	8.1	33.0	83.3
5	3	-20.2	33.0	12	11	8.1	33.0	67.1
6	4	9.5	33.0	12	11	8.1	33.0	79.4
7	4	21.4	33.0	12	11	8.1	33.0	49.4
7	8	8.1	33.0	12	11	8.1	33.0	102.9
7	9	24.9	33.0	12	11	8.1	33.0	85.9
8	7	-6.9	33.0	12	11	8.1	33.0	77.9
9	7	12.9	33.0	12	11	8.1	33.0	52.3
9	10	5.8	33.0	12	11	8.1	33.0	82.0
9	11	23.8	33.0	12	11	8.1	33.0	47.9
10	9	0.8	33.0	12	11	8.1	33.0	69.9
11	9	8.8	33.0	12	11	8.1	33.0	62.9
11	12	8.1	33.0	12	11	8.1	33.0	-62.5
11	13	18.3	33.0	12	11	8.1	33.0	67.0
13	11	18.3	33.0	12	11	8.1	33.0	34.0
13	14	10.7	33.0	12	11	8.1	33.0	74.0
13	15	21.9	33.0	12	11	8.1	33.0	55.8
14	13	10.7	33.0	12	11	8.1	33.0	72.9
15	13	21.9	33.0	12	11	8.1	33.0	84.0
15	16	0.3	33.0	12	11	8.1	33.0	71.8
15	17	1.1	33.0	12	11	8.1	33.0	76.0
16	15	0.3	33.0	12	11	8.1	33.0	74.8
17	15	1.1	33.0	12	11	8.1	33.0	78.8
18	19	30.0	24.9	12	11	8.1	33.0	99.4
19	18	30.0	24.9	12	11	8.1	33.0	61.5
20	21	30.0	24.9	12	11	8.1	33.0	100.7
21	20	30.0	24.9	12	11	8.1	33.0	93.9
22	23	18.4	24.6	12	11	8.1	33.0	107.0
23	22	18.4	24.6	12	11	8.1	33.0	103.1

24	25	18.4	24.6	12	11	8.1	33.0	98.7
25	24	18.4	24.6	12	11	8.1	33.0	102.7
26	27	18.4	24.6	12	11	8.1	33.0	81.6
27	26	18.4	24.6	12	11	8.1	33.0	81.5
28	29	30.0	25.1	12	11	8.1	33.0	95.3
29	28	30.0	25.1	12	11	8.1	33.0	75.9
30	31	30.0	25.1	12	11	8.1	33.0	96.2
31	30	30.0	25.1	12	11	8.1	33.0	89.5
32	33	18.4	24.6	12	11	8.1	33.0	89.0
33	32	18.4	24.6	12	11	8.1	33.0	68.9
34	35	18.4	24.6	12	11	8.1	33.0	91.8
35	34	18.4	24.6	12	11	8.1	33.0	95.4
1	2	12.4	33.0	13	11	18.3	33.0	46.3
2	1	12.4	33.0	13	11	18.3	33.0	84.7
2	3	8.8	33.0	13	11	18.3	33.0	60.6
2	4	19.7	33.0	13	11	18.3	33.0	56.6
3	2	8.8	33.0	13	11	18.3	33.0	74.3
3	5	-20.2	33.0	13	11	18.3	33.0	41.8
4	2	21.7	33.0	13	11	18.3	33.0	79.3
4	6	9.5	33.0	13	11	18.3	33.0	73.6
4	7	21.4	33.0	13	11	18.3	33.0	64.5
5	3	-20.2	33.0	13	11	18.3	33.0	51.6
6	4	9.5	33.0	13	11	18.3	33.0	59.6
7	4	21.4	33.0	13	11	18.3	33.0	41.6
7	8	8.1	33.0	13	11	18.3	33.0	84.2
7	9	24.9	33.0	13	11	18.3	33.0	68.8
8	7	-6.9	33.0	13	11	18.3	33.0	59.2
9	7	12.9	33.0	13	11	18.3	33.0	21.6
9	10	5.8	33.0	13	11	18.3	33.0	64.5
9	11	23.8	33.0	13	11	18.3	33.0	49.0
10	9	0.8	33.0	13	11	18.3	33.0	58.8
11	9	8.8	33.0	13	11	18.3	33.0	38.7
11	12	8.1	33.0	13	11	18.3	33.0	51.8
11	13	18.3	33.0	13	11	18.3	33.0	-53.7
12	11	8.1	33.0	13	11	18.3	33.0	24.0
13	14	10.7	33.0	13	11	18.3	33.0	25.4
13	15	21.9	33.0	13	11	18.3	33.0	42.6
14	13	10.7	33.0	13	11	18.3	33.0	-48.7
15	13	21.9	33.0	13	11	18.3	33.0	-53.7
15	16	0.3	33.0	13	11	18.3	33.0	58.4
15	17	1.1	33.0	13	11	18.3	33.0	63.3
16	15	0.3	33.0	13	11	18.3	33.0	61.6
17	15	1.1	33.0	13	11	18.3	33.0	65.6
18	19	30.0	24.9	13	11	18.3	33.0	89.9
19	18	30.0	24.9	13	11	18.3	33.0	51.9
20	21	30.0	24.9	13	11	18.3	33.0	73.9
21	20	30.0	24.9	13	11	18.3	33.0	55.2
22	23	18.4	24.6	13	11	18.3	33.0	96.2
23	22	18.4	24.6	13	11	18.3	33.0	92.2
24	25	18.4	24.6	13	11	18.3	33.0	93.9
25	24	18.4	24.6	13	11	18.3	33.0	97.8
26	27	18.4	24.6	13	11	18.3	33.0	74.8
27	26	18.4	24.6	13	11	18.3	33.0	78.7
28	29	30.0	25.1	13	11	18.3	33.0	86.2
29	28	30.0	25.1	13	11	18.3	33.0	66.6
30	31	30.0	25.1	13	11	18.3	33.0	79.8
31	30	30.0	25.1	13	11	18.3	33.0	69.1
32	33	18.4	24.6	13	11	18.3	33.0	78.3
33	32	18.4	24.6	13	11	18.3	33.0	62.2
34	35	18.4	24.6	13	11	18.3	33.0	81.0
35	34	18.4	24.6	13	11	18.3	33.0	84.6
1	2	12.4	33.0	13	14	10.7	33.0	57.9
2	1	12.4	33.0	13	14	10.7	33.0	96.3
2	3	8.8	33.0	13	14	10.7	33.0	79.2
2	4	19.7	33.0	13	14	10.7	33.0	79.2
3	2	8.8	33.0	13	14	10.7	33.0	85.9

3	5	-20.2	33.0	13	14	10.7	33.0	60.4
4	2	21.7	33.0	13	14	10.7	33.0	90.9
4	6	9.5	33.0	13	14	10.7	33.0	92.2
4	7	21.4	33.0	13	14	10.7	33.0	87.1
5	3	-20.2	33.0	13	14	10.7	33.0	70.2
6	4	9.5	33.0	13	14	10.7	33.0	82.2
7	4	21.4	33.0	13	14	10.7	33.0	64.2
7	8	8.1	33.0	13	14	10.7	33.0	106.8
7	9	24.9	33.0	13	14	10.7	33.0	91.4
8	7	-6.9	33.0	13	14	10.7	33.0	81.8
9	7	12.9	33.0	13	14	10.7	33.0	44.2
9	10	5.8	33.0	13	14	10.7	33.0	87.1
9	11	23.8	33.0	13	14	10.7	33.0	89.6
10	9	0.8	33.0	13	14	10.7	33.0	81.4
11	9	8.8	33.0	13	14	10.7	33.0	61.3
11	12	8.1	33.0	13	14	10.7	33.0	70.4
11	13	18.3	33.0	13	14	10.7	33.0	-36.1
12	11	8.1	33.0	13	14	10.7	33.0	64.6
13	11	18.3	33.0	13	14	10.7	33.0	40.6
13	15	21.9	33.0	13	14	10.7	33.0	50.2
X FOR DIST =			0.10000D+01					
X FOR DIST =			0.10000D+01					
14	13	10.7	33.0	13	14	10.7	33.0	-31.1
15	13	21.9	33.0	13	14	10.7	33.0	-36.1
15	16	0.3	33.0	13	14	10.7	33.0	72.0
15	17	1.1	33.0	13	14	10.7	33.0	60.9
16	15	0.3	33.0	13	14	10.7	33.0	69.2
17	15	1.1	33.0	13	14	10.7	33.0	73.2
18	19	30.0	24.9	13	14	10.7	33.0	97.5
19	18	30.0	24.9	13	14	10.7	33.0	59.5
20	21	30.0	24.9	13	14	10.7	33.0	102.5
21	20	30.0	24.9	13	14	10.7	33.0	95.8
22	23	18.4	24.6	13	14	10.7	33.0	86.8
23	22	18.4	24.6	13	14	10.7	33.0	82.8
24	25	18.4	24.6	13	14	10.7	33.0	101.5
25	24	18.4	24.6	13	14	10.7	33.0	105.4
26	27	18.4	24.6	13	14	10.7	33.0	88.4
27	26	18.4	24.6	13	14	10.7	33.0	92.3
28	29	30.0	25.1	13	14	10.7	33.0	97.8
29	28	30.0	25.1	13	14	10.7	33.0	78.2
30	31	30.0	25.1	13	14	10.7	33.0	98.4
31	30	30.0	25.1	13	14	10.7	33.0	91.7
32	33	18.4	24.6	13	14	10.7	33.0	95.9
33	32	18.4	24.6	13	14	10.7	33.0	79.8
34	35	18.4	24.6	13	14	10.7	33.0	71.6
35	34	18.4	24.6	13	14	10.7	33.0	75.2
1	2	12.4	33.0	13	15	21.9	33.0	52.7
2	1	12.4	33.0	13	15	21.9	33.0	91.1
2	3	8.8	33.0	13	15	21.9	33.0	74.0
2	4	19.7	33.0	13	15	21.9	33.0	74.0
3	2	8.8	33.0	13	15	21.9	33.0	80.7
3	5	-20.2	33.0	13	15	21.9	33.0	55.2
4	2	21.7	33.0	13	15	21.9	33.0	85.7
4	6	9.5	33.0	13	15	21.9	33.0	87.0
4	7	21.4	33.0	13	15	21.9	33.0	81.9
5	3	-20.2	33.0	13	15	21.9	33.0	65.0
6	4	9.5	33.0	13	15	21.9	33.0	77.0
7	4	21.4	33.0	13	15	21.9	33.0	59.0
7	8	8.1	33.0	13	15	21.9	33.0	101.6
7	9	24.9	33.0	13	15	21.9	33.0	86.2
8	7	-6.9	33.0	13	15	21.9	33.0	76.6
9	7	12.9	33.0	13	15	21.9	33.0	39.0
9	10	5.8	33.0	13	15	21.9	33.0	81.9
9	11	23.8	33.0	13	15	21.9	33.0	84.4
10	9	0.8	33.0	13	15	21.9	33.0	76.2
11	9	8.8	33.0	13	15	21.9	33.0	56.1

11	12	8.1	33.0	13	15	21.9	33.0	65.2
11	13	18.3	33.0	13	15	21.9	33.0	-57.3
12	11	8.1	33.0	13	15	21.9	33.0	59.4
13	11	18.3	33.0	13	15	21.9	33.0	35.4
13	14	10.7	33.0	13	15	21.9	33.0	27.8
14	13	10.7	33.0	13	15	21.9	33.0	-52.3
15	13	21.9	33.0	13	15	21.9	33.0	-57.3
15	16	0.3	33.0	13	15	21.9	33.0	39.8
15	17	1.1	33.0	13	15	21.9	33.0	59.7
16	15	0.3	33.0	13	15	21.9	33.0	19.0
17	15	1.1	33.0	13	15	21.9	33.0	23.0
18	19	30.0	24.9	13	15	21.9	33.0	96.3
19	18	30.0	24.9	13	15	21.9	33.0	58.3
20	21	30.0	24.9	13	15	21.9	33.0	97.3
21	20	30.0	24.9	13	15	21.9	33.0	90.6
22	23	18.4	24.6	13	15	21.9	33.0	92.6
23	22	18.4	24.6	13	15	21.9	33.0	88.6
24	25	18.4	24.6	13	15	21.9	33.0	51.3
25	24	18.4	24.6	13	15	21.9	33.0	55.2
26	27	18.4	24.6	13	15	21.9	33.0	67.2
27	26	18.4	24.6	13	15	21.9	33.0	71.1
28	29	30.0	25.1	13	15	21.9	33.0	92.6
29	28	30.0	25.1	13	15	21.9	33.0	73.0
30	31	30.0	25.1	13	15	21.9	33.0	93.2
31	30	30.0	25.1	13	15	21.9	33.0	86.5
32	33	18.4	24.6	13	15	21.9	33.0	74.7
33	32	18.4	24.6	13	15	21.9	33.0	58.6
34	35	18.4	24.6	13	15	21.9	33.0	77.4
35	34	18.4	24.6	13	15	21.9	33.0	81.0
1	2	12.4	33.0	14	13	10.7	33.0	66.4
2	1	12.4	33.0	14	13	10.7	33.0	92.9
2	3	8.8	33.0	14	13	10.7	33.0	76.1
2	4	19.7	33.0	14	13	10.7	33.0	76.3
3	2	8.8	33.0	14	13	10.7	33.0	82.5
3	5	-20.2	33.0	14	13	10.7	33.0	57.2
4	2	21.7	33.0	14	13	10.7	33.0	87.5
4	6	9.5	33.0	14	13	10.7	33.0	89.1
4	7	21.4	33.0	14	13	10.7	33.0	84.7
5	3	-20.2	33.0	14	13	10.7	33.0	67.0
6	4	9.5	33.0	14	13	10.7	33.0	79.2
7	4	21.4	33.0	14	13	10.7	33.0	49.2
7	8	8.1	33.0	14	13	10.7	33.0	104.3
7	9	24.9	33.0	14	13	10.7	33.0	89.9
8	7	-6.9	33.0	14	13	10.7	33.0	79.4
9	7	12.9	33.0	14	13	10.7	33.0	63.7
9	10	5.8	33.0	14	13	10.7	33.0	85.3
9	11	23.8	33.0	14	13	10.7	33.0	76.8
10	9	0.8	33.0	14	13	10.7	33.0	73.9
11	9	8.8	33.0	14	13	10.7	33.0	66.9
11	12	8.1	33.0	14	13	10.7	33.0	71.5
11	13	18.3	33.0	14	13	10.7	33.0	38.0
12	11	8.1	33.0	14	13	10.7	33.0	46.8
13	11	18.3	33.0	14	13	10.7	33.0	55.8

X FOR DIST = 0.10000D+01

X FOR DIST = 0.10000D+01

13	14	10.7	33.0	14	13	10.7	33.0	67.8
13	15	21.9	33.0	14	13	10.7	33.0	62.4
15	13	21.9	33.0	14	13	10.7	33.0	44.0
15	16	0.3	33.0	14	13	10.7	33.0	59.3
15	17	1.1	33.0	14	13	10.7	33.0	60.3
16	15	0.3	33.0	14	13	10.7	33.0	59.4
17	15	1.1	33.0	14	13	10.7	33.0	63.4
18	19	30.0	24.9	14	13	10.7	33.0	97.7
19	18	30.0	24.9	14	13	10.7	33.0	71.7
20	21	30.0	24.9	14	13	10.7	33.0	98.9
21	20	30.0	24.9	14	13	10.7	33.0	92.3

22	23	18.4	24.6	14	13	10.7	33.0	102.7
23	22	18.4	24.6	14	13	10.7	33.0	98.7
24	25	18.4	24.6	14	13	10.7	33.0	91.4
25	24	18.4	24.6	14	13	10.7	33.0	95.4
26	27	18.4	24.6	14	13	10.7	33.0	79.1
27	26	18.4	24.6	14	13	10.7	33.0	82.8
28	29	30.0	25.1	14	13	10.7	33.0	94.1
29	28	30.0	25.1	14	13	10.7	33.0	68.6
30	31	30.0	25.1	14	13	10.7	33.0	94.8
31	30	30.0	25.1	14	13	10.7	33.0	88.3
32	33	18.4	24.6	14	13	10.7	33.0	86.6
33	32	18.4	24.6	14	13	10.7	33.0	70.4
34	35	18.4	24.6	14	13	10.7	33.0	87.7
35	34	18.4	24.6	14	13	10.7	33.0	91.2
1	2	12.4	33.0	15	13	21.9	33.0	28.7
2	1	12.4	33.0	15	13	21.9	33.0	55.2
2	3	8.8	33.0	15	13	21.9	33.0	50.2
2	4	19.7	33.0	15	13	21.9	33.0	59.8
3	2	8.8	33.0	15	13	21.9	33.0	44.7
3	5	-20.2	33.0	15	13	21.9	33.0	31.3
4	2	21.7	33.0	15	13	21.9	33.0	49.7
4	6	9.5	33.0	15	13	21.9	33.0	68.8
4	7	21.4	33.0	15	13	21.9	33.0	65.1
5	3	-20.2	33.0	15	13	21.9	33.0	41.1
6	4	9.5	33.0	15	13	21.9	33.0	62.7
7	4	21.4	33.0	15	13	21.9	33.0	50.7
7	8	8.1	33.0	15	13	21.9	33.0	84.7
7	9	24.9	33.0	15	13	21.9	33.0	70.9
8	7	-6.9	33.0	15	13	21.9	33.0	59.7
9	7	12.9	33.0	15	13	21.9	33.0	22.1
9	10	5.8	33.0	15	13	21.9	33.0	66.3
9	11	23.8	33.0	15	13	21.9	33.0	71.0
10	9	0.8	33.0	15	13	21.9	33.0	60.9
11	9	8.8	33.0	15	13	21.9	33.0	30.9
11	12	8.1	33.0	15	13	21.9	33.0	37.0
11	13	18.3	33.0	15	13	21.9	33.0	39.0
12	11	8.1	33.0	15	13	21.9	33.0	46.0
13	11	18.3	33.0	15	13	21.9	33.0	44.0
13	14	10.7	33.0	15	13	21.9	33.0	46.1
13	15	21.9	33.0	15	13	21.9	33.0	-61.2
14	13	10.7	33.0	15	13	21.9	33.0	34.0
15	16	0.3	33.0	15	13	21.9	33.0	7.4
15	17	1.1	33.0	15	13	21.9	33.0	12.2
16	15	0.3	33.0	15	13	21.9	33.0	-71.2
17	15	1.1	33.0	15	13	21.9	33.0	-61.2
18	19	30.0	24.9	15	13	21.9	33.0	59.0
19	18	30.0	24.9	15	13	21.9	33.0	20.8
20	21	30.0	24.9	15	13	21.9	33.0	81.3
21	20	30.0	24.9	15	13	21.9	33.0	74.7
22	23	18.4	24.6	15	13	21.9	33.0	81.4
23	22	18.4	24.6	15	13	21.9	33.0	81.4
24	25	18.4	24.6	15	13	21.9	33.0	88.5
25	24	18.4	24.6	15	13	21.9	33.0	92.5
26	27	18.4	24.6	15	13	21.9	33.0	69.7
27	26	18.4	24.6	15	13	21.9	33.0	73.3
28	29	30.0	25.1	15	13	21.9	33.0	55.7
29	28	30.0	25.1	15	13	21.9	33.0	35.9
30	31	30.0	25.1	15	13	21.9	33.0	67.9
31	30	30.0	25.1	15	13	21.9	33.0	71.2
32	33	18.4	24.6	15	13	21.9	33.0	77.4
33	32	18.4	24.6	15	13	21.9	33.0	68.3
34	35	18.4	24.6	15	13	21.9	33.0	70.1
35	34	18.4	24.6	15	13	21.9	33.0	73.8
1	2	12.4	33.0	15	16	0.3	33.0	79.3
2	1	12.4	33.0	15	16	0.3	33.0	105.8
2	3	8.8	33.0	15	16	0.3	33.0	88.8

2	4	19.7	33.0	15	16	0.3	33.0	88.4
3	2	8.8	33.0	15	16	0.3	33.0	95.3
3	5	-20.2	33.0	15	16	0.3	33.0	69.9
4	2	21.7	33.0	15	16	0.3	33.0	100.3
4	6	9.5	33.0	15	16	0.3	33.0	101.4
4	7	21.4	33.0	15	16	0.3	33.0	97.7
5	3	-20.2	33.0	15	16	0.3	33.0	79.7
6	4	9.5	33.0	15	16	0.3	33.0	91.3
7	4	21.4	33.0	15	16	0.3	33.0	79.3
7	8	8.1	33.0	15	16	0.3	33.0	117.3
7	9	24.9	33.0	15	16	0.3	33.0	103.5
8	7	-6.9	33.0	15	16	0.3	33.0	92.3
9	7	12.9	33.0	15	16	0.3	33.0	54.7
9	10	5.8	33.0	15	16	0.3	33.0	98.9
9	11	23.8	33.0	15	16	0.3	33.0	103.6
10	9	0.8	33.0	15	16	0.3	33.0	93.5
11	9	8.8	33.0	15	16	0.3	33.0	63.5
11	12	8.1	33.0	15	16	0.3	33.0	87.6
11	13	18.3	33.0	15	16	0.3	33.0	89.6
12	11	8.1	33.0	15	16	0.3	33.0	78.6
13	11	18.3	33.0	15	16	0.3	33.0	76.6
13	14	10.7	33.0	15	16	0.3	33.0	74.7
13	15	21.9	33.0	15	16	0.3	33.0	-39.6
14	13	10.7	33.0	15	16	0.3	33.0	84.6
15	13	21.9	33.0	15	16	0.3	33.0	50.6
15	17	1.1	33.0	15	16	0.3	33.0	39.8
16	15	0.3	33.0	15	16	0.3	33.0	-49.6
17	15	1.1	33.0	15	16	0.3	33.0	-39.6
18	19	30.0	24.9	15	16	0.3	33.0	109.6
19	18	30.0	24.9	15	16	0.3	33.0	71.4
20	21	30.0	24.9	15	16	0.3	33.0	102.9
21	20	30.0	24.9	15	16	0.3	33.0	96.3
22	23	18.4	24.6	15	16	0.3	33.0	109.0
23	22	18.4	24.6	15	16	0.3	33.0	109.0
24	25	18.4	24.6	15	16	0.3	33.0	104.1
25	24	18.4	24.6	15	16	0.3	33.0	108.1
26	27	18.4	24.6	15	16	0.3	33.0	87.3
27	26	18.4	24.6	15	16	0.3	33.0	90.9
28	29	30.0	25.1	15	16	0.3	33.0	106.3
29	28	30.0	25.1	15	16	0.3	33.0	86.5
30	31	30.0	25.1	15	16	0.3	33.0	106.5
31	30	30.0	25.1	15	16	0.3	33.0	99.8
32	33	18.4	24.6	15	16	0.3	33.0	95.0
33	32	18.4	24.6	15	16	0.3	33.0	85.9
34	35	18.4	24.6	15	16	0.3	33.0	97.7
35	34	18.4	24.6	15	16	0.3	33.0	101.4
1	2	12.4	33.0	15	17	1.1	33.0	82.5
2	1	12.4	33.0	15	17	1.1	33.0	109.0
2	3	8.8	33.0	15	17	1.1	33.0	98.0
2	4	19.7	33.0	15	17	1.1	33.0	97.6
3	2	8.8	33.0	15	17	1.1	33.0	98.5
3	5	-20.2	33.0	15	17	1.1	33.0	79.1
4	2	21.7	33.0	15	17	1.1	33.0	103.5
4	6	9.5	33.0	15	17	1.1	33.0	110.6
4	7	21.4	33.0	15	17	1.1	33.0	106.9
5	3	-20.2	33.0	15	17	1.1	33.0	88.9
6	4	9.5	33.0	15	17	1.1	33.0	100.5
7	4	21.4	33.0	15	17	1.1	33.0	88.5
7	8	8.1	33.0	15	17	1.1	33.0	126.5
7	9	24.9	33.0	15	17	1.1	33.0	112.7
8	7	-6.9	33.0	15	17	1.1	33.0	101.5
9	7	12.9	33.0	15	17	1.1	33.0	63.9
9	10	5.8	33.0	15	17	1.1	33.0	108.1
9	11	23.8	33.0	15	17	1.1	33.0	112.8
10	9	0.8	33.0	15	17	1.1	33.0	102.7
11	9	8.8	33.0	15	17	1.1	33.0	72.7

11	12	8.1	33.0	15	17	1.1	33.0	90.8
11	13	18.3	33.0	15	17	1.1	33.0	92.8
12	11	8.1	33.0	15	17	1.1	33.0	87.8
13	11	18.3	33.0	15	17	1.1	33.0	85.8
13	14	10.7	33.0	15	17	1.1	33.0	77.9
13	15	21.9	33.0	15	17	1.1	33.0	-30.4
14	13	10.7	33.0	15	17	1.1	33.0	87.8
15	13	21.9	33.0	15	17	1.1	33.0	53.8
15	16	0.3	33.0	15	17	1.1	33.0	38.2
16	15	0.3	33.0	15	17	1.1	33.0	-40.4
17	15	1.1	33.0	15	17	1.1	33.0	-30.4
18	19	30.0	24.9	15	17	1.1	33.0	112.8
19	18	30.0	24.9	15	17	1.1	33.0	74.6
20	21	30.0	24.9	15	17	1.1	33.0	119.1
21	20	30.0	24.9	15	17	1.1	33.0	112.5
22	23	18.4	24.6	15	17	1.1	33.0	91.2
23	22	18.4	24.6	15	17	1.1	33.0	91.2
24	25	18.4	24.6	15	17	1.1	33.0	109.3
25	24	18.4	24.6	15	17	1.1	33.0	113.3
26	27	18.4	24.6	15	17	1.1	33.0	96.5
27	26	18.4	24.6	15	17	1.1	33.0	100.1
28	29	30.0	25.1	15	17	1.1	33.0	109.5
29	28	30.0	25.1	15	17	1.1	33.0	89.7
30	31	30.0	25.1	15	17	1.1	33.0	115.7
31	30	30.0	25.1	15	17	1.1	33.0	109.0
32	33	18.4	24.6	15	17	1.1	33.0	104.2
33	32	18.4	24.6	15	17	1.1	33.0	95.1
34	35	18.4	24.6	15	17	1.1	33.0	75.9
35	34	18.4	24.6	15	17	1.1	33.0	83.6
1	2	12.4	33.0	16	15	0.3	33.0	109.9
2	1	12.4	33.0	16	15	0.3	33.0	109.4
2	3	8.8	33.0	16	15	0.3	33.0	92.3
2	4	19.7	33.0	16	15	0.3	33.0	97.8
3	2	8.8	33.0	16	15	0.3	33.0	88.9
3	5	-20.2	33.0	16	15	0.3	33.0	73.4
4	2	21.7	33.0	16	15	0.3	33.0	93.9
4	6	9.5	33.0	16	15	0.3	33.0	104.8
4	7	21.4	33.0	16	15	0.3	33.0	101.0
5	3	-20.2	33.0	16	15	0.3	33.0	83.2
6	4	9.5	33.0	16	15	0.3	33.0	100.8
7	4	21.4	33.0	16	15	0.3	33.0	92.8
7	8	8.1	33.0	16	15	0.3	33.0	120.6
7	9	24.9	33.0	16	15	0.3	33.0	106.6
8	7	-6.9	33.0	16	15	0.3	33.0	95.6
9	7	12.9	33.0	16	15	0.3	33.0	70.0
9	10	5.8	33.0	16	15	0.3	33.0	102.1
9	11	23.8	33.0	16	15	0.3	33.0	106.4
10	9	0.8	33.0	16	15	0.3	33.0	96.6
11	9	8.8	33.0	16	15	0.3	33.0	54.6
11	12	8.1	33.0	16	15	0.3	33.0	84.6
11	13	18.3	33.0	16	15	0.3	33.0	86.3
12	11	8.1	33.0	16	15	0.3	33.0	81.5
13	11	18.3	33.0	16	15	0.3	33.0	79.5
13	14	10.7	33.0	16	15	0.3	33.0	74.6
13	15	21.9	33.0	16	15	0.3	33.0	39.0
14	13	10.7	33.0	16	15	0.3	33.0	87.3
15	13	21.9	33.0	16	15	0.3	33.0	71.3
15	16	0.3	33.0	16	15	0.3	33.0	-32.6
15	17	1.1	33.0	16	15	0.3	33.0	6.4
17	15	1.1	33.0	16	15	0.3	33.0	39.0
18	19	30.0	24.9	16	15	0.3	33.0	113.4
19	18	30.0	24.9	16	15	0.3	33.0	75.2
20	21	30.0	24.9	16	15	0.3	33.0	119.7
21	20	30.0	24.9	16	15	0.3	33.0	113.0
22	23	18.4	24.6	16	15	0.3	33.0	92.6
23	22	18.4	24.6	16	15	0.3	33.0	88.6

24	25	18.4	24.6	16	15	0.3	33.0	110.4
25	24	18.4	24.6	16	15	0.3	33.0	114.4
26	27	18.4	24.6	16	15	0.3	33.0	97.1
27	26	18.4	24.6	16	15	0.3	33.0	100.7
28	29	30.0	25.1	16	15	0.3	33.0	110.0
29	28	30.0	25.1	16	15	0.3	33.0	111.2
30	31	30.0	25.1	16	15	0.3	33.0	110.2
31	30	30.0	25.1	16	15	0.3	33.0	109.5
32	33	18.4	24.6	16	15	0.3	33.0	104.7
33	32	18.4	24.6	16	15	0.3	33.0	88.7
34	35	18.4	24.6	16	15	0.3	33.0	71.3
35	34	18.4	24.6	16	15	0.3	33.0	81.0
1	2	12.4	33.0	17	15	1.1	33.0	67.0
2	1	12.4	33.0	17	15	1.1	33.0	105.6
2	3	8.8	33.0	17	15	1.1	33.0	88.6
2	4	19.7	33.0	17	15	1.1	33.0	81.2
3	2	8.8	33.0	17	15	1.1	33.0	95.0
3	5	-20.2	33.0	17	15	1.1	33.0	69.7
4	2	21.7	33.0	17	15	1.1	33.0	100.0
4	6	9.5	33.0	17	15	1.1	33.0	101.2
4	7	21.4	33.0	17	15	1.1	33.0	97.7
5	3	-20.2	33.0	17	15	1.1	33.0	79.5
6	4	9.5	33.0	17	15	1.1	33.0	84.2
7	4	21.4	33.0	17	15	1.1	33.0	72.2
7	8	8.1	33.0	17	15	1.1	33.0	117.3
7	9	24.9	33.0	17	15	1.1	33.0	103.7
8	7	-6.9	33.0	17	15	1.1	33.0	92.3
9	7	12.9	33.0	17	15	1.1	33.0	54.7
9	10	5.8	33.0	17	15	1.1	33.0	99.1
9	11	23.8	33.0	17	15	1.1	33.0	97.0
10	9	0.8	33.0	17	15	1.1	33.0	93.7
11	9	8.8	33.0	17	15	1.1	33.0	69.7
11	12	8.1	33.0	17	15	1.1	33.0	88.0
11	13	18.3	33.0	17	15	1.1	33.0	90.5
12	11	8.1	33.0	17	15	1.1	33.0	72.1
13	11	18.3	33.0	17	15	1.1	33.0	70.1
13	14	10.7	33.0	17	15	1.1	33.0	74.8
13	15	21.9	33.0	17	15	1.1	33.0	43.0
14	13	10.7	33.0	17	15	1.1	33.0	75.5
15	13	21.9	33.0	17	15	1.1	33.0	90.5
15	16	0.3	33.0	17	15	1.1	33.0	5.6
15	17	1.1	33.0	17	15	1.1	33.0	-48.7
16	15	0.3	33.0	17	15	1.1	33.0	39.0
18	19	30.0	24.9	17	15	1.1	33.0	109.1
19	18	30.0	24.9	17	15	1.1	33.0	82.9
20	21	30.0	24.9	17	15	1.1	33.0	102.4
21	20	30.0	24.9	17	15	1.1	33.0	95.8
22	23	18.4	24.6	17	15	1.1	33.0	107.4
23	22	18.4	24.6	17	15	1.1	33.0	107.4
24	25	18.4	24.6	17	15	1.1	33.0	103.0
25	24	18.4	24.6	17	15	1.1	33.0	106.9
26	27	18.4	24.6	17	15	1.1	33.0	86.7
27	26	18.4	24.6	17	15	1.1	33.0	90.2
28	29	30.0	25.1	17	15	1.1	33.0	105.9
29	28	30.0	25.1	17	15	1.1	33.0	86.1
30	31	30.0	25.1	17	15	1.1	33.0	106.0
31	30	30.0	25.1	17	15	1.1	33.0	92.5
32	33	18.4	24.6	17	15	1.1	33.0	94.5
33	32	18.4	24.6	17	15	1.1	33.0	85.3
34	35	18.4	24.6	17	15	1.1	33.0	96.2
35	34	18.4	24.6	17	15	1.1	33.0	100.0
1	2	12.4	33.0	18	19	30.0	24.9	54.4
2	1	12.4	33.0	18	19	30.0	24.9	37.9
2	3	8.8	33.0	18	19	30.0	24.9	46.2
2	4	19.7	33.0	18	19	30.0	24.9	59.6
3	2	8.8	33.0	18	19	30.0	24.9	37.4

3	5	-20.2	33.0	18	19	30.0	24.9	35.1
4	2	21.7	33.0	18	19	30.0	24.9	42.4
4	6	9.5	33.0	18	19	30.0	24.9	66.2
4	7	21.4	33.0	18	19	30.0	24.9	53.0
5	3	-20.2	33.0	18	19	30.0	24.9	31.1
6	4	9.5	33.0	18	19	30.0	24.9	62.5
7	4	21.4	33.0	18	19	30.0	24.9	65.5
7	8	8.1	33.0	18	19	30.0	24.9	76.6
7	9	24.9	33.0	18	19	30.0	24.9	43.0
8	7	-6.9	33.0	18	19	30.0	24.9	57.6
9	7	12.9	33.0	18	19	30.0	24.9	59.0
9	10	5.8	33.0	18	19	30.0	24.9	54.8
9	11	23.8	33.0	18	19	30.0	24.9	41.7
10	9	0.8	33.0	18	19	30.0	24.9	11.0
11	9	8.8	33.0	18	19	30.0	24.9	47.0
11	12	8.1	33.0	18	19	30.0	24.9	37.9
11	13	18.3	33.0	18	19	30.0	24.9	43.6
12	11	8.1	33.0	18	19	30.0	24.9	41.8
13	11	18.3	33.0	18	19	30.0	24.9	46.7
13	14	10.7	33.0	18	19	30.0	24.9	50.7
13	15	21.9	33.0	18	19	30.0	24.9	16.1
14	13	10.7	33.0	18	19	30.0	24.9	38.6
15	13	21.9	33.0	18	19	30.0	24.9	53.6
15	16	0.3	33.0	18	19	30.0	24.9	38.9
15	17	1.1	33.0	18	19	30.0	24.9	47.3
16	15	0.3	33.0	18	19	30.0	24.9	35.1
17	15	1.1	33.0	18	19	30.0	24.9	39.1
19	18	30.0	24.9	18	19	30.0	24.9	-56.5
20	21	30.0	24.9	18	19	30.0	24.9	82.1
21	20	30.0	24.9	18	19	30.0	24.9	72.2
22	23	18.4	24.6	18	19	30.0	24.9	99.3
23	22	18.4	24.6	18	19	30.0	24.9	95.4
24	25	18.4	24.6	18	19	30.0	24.9	57.3
25	24	18.4	24.6	18	19	30.0	24.9	61.3
26	27	18.4	24.6	18	19	30.0	24.9	63.3
27	26	18.4	24.6	18	19	30.0	24.9	63.3
28	29	30.0	25.1	18	19	30.0	24.9	50.4
29	28	30.0	25.1	18	19	30.0	24.9	61.6
30	31	30.0	25.1	18	19	30.0	24.9	73.8
31	30	30.0	25.1	18	19	30.0	24.9	50.4
32	33	18.4	24.6	18	19	30.0	24.9	74.7
33	32	18.4	24.6	18	19	30.0	24.9	48.2
34	35	18.4	24.6	18	19	30.0	24.9	76.4
35	34	18.4	24.6	18	19	30.0	24.9	93.1
1	2	12.4	33.0	19	18	30.0	24.9	91.5
2	1	12.4	33.0	19	18	30.0	24.9	75.1
2	3	8.8	33.0	19	18	30.0	24.9	71.5
2	4	19.7	33.0	19	18	30.0	24.9	75.1
3	2	8.8	33.0	19	18	30.0	24.9	74.5
3	5	-20.2	33.0	19	18	30.0	24.9	60.4
4	2	21.7	33.0	19	18	30.0	24.9	79.6
4	6	9.5	33.0	19	18	30.0	24.9	81.5
4	7	21.4	33.0	19	18	30.0	24.9	78.6
5	3	-20.2	33.0	19	18	30.0	24.9	56.5
6	4	9.5	33.0	19	18	30.0	24.9	78.0
7	4	21.4	33.0	19	18	30.0	24.9	81.0
7	8	8.1	33.0	19	18	30.0	24.9	102.3
7	9	24.9	33.0	19	18	30.0	24.9	80.8
8	7	-6.9	33.0	19	18	30.0	24.9	83.3
9	7	12.9	33.0	19	18	30.0	24.9	84.7
9	10	5.8	33.0	19	18	30.0	24.9	92.6
9	11	23.8	33.0	19	18	30.0	24.9	79.6
10	9	0.8	33.0	19	18	30.0	24.9	48.8
11	9	8.8	33.0	19	18	30.0	24.9	84.8
11	12	8.1	33.0	19	18	30.0	24.9	75.9
11	13	18.3	33.0	19	18	30.0	24.9	81.6

12	11	8.1	33.0	19	18	30.0	24.9	79.7
13	11	18.3	33.0	19	18	30.0	24.9	84.6
13	14	10.7	33.0	19	18	30.0	24.9	76.7
13	15	21.9	33.0	19	18	30.0	24.9	54.2
14	13	10.7	33.0	19	18	30.0	24.9	76.6
15	13	21.9	33.0	19	18	30.0	24.9	91.6
15	16	0.3	33.0	19	18	30.0	24.9	77.0
15	17	1.1	33.0	19	18	30.0	24.9	73.5
16	15	0.3	33.0	19	18	30.0	24.9	73.3
17	15	1.1	33.0	19	18	30.0	24.9	77.3
18	19	30.0	24.9	19	18	30.0	24.9	-59.5
20	21	30.0	24.9	19	18	30.0	24.9	82.3
21	20	30.0	24.9	19	18	30.0	24.9	72.2
22	23	18.4	24.6	19	18	30.0	24.9	98.7
23	22	18.4	24.6	19	18	30.0	24.9	94.8
24	25	18.4	24.6	19	18	30.0	24.9	95.8
25	24	18.4	24.6	19	18	30.0	24.9	99.8
26	27	18.4	24.6	19	18	30.0	24.9	83.7
27	26	18.4	24.6	19	18	30.0	24.9	83.8
28	29	30.0	25.1	19	18	30.0	24.9	74.3
29	28	30.0	25.1	19	18	30.0	24.9	74.7
30	31	30.0	25.1	19	18	30.0	24.9	76.1
31	30	30.0	25.1	19	18	30.0	24.9	63.1
32	33	18.4	24.6	19	18	30.0	24.9	91.1
33	32	18.4	24.6	19	18	30.0	24.9	64.6
34	35	18.4	24.6	19	18	30.0	24.9	82.9
35	34	18.4	24.6	19	18	30.0	24.9	92.6
1	2	12.4	33.0	20	21	30.0	24.9	91.5
2	1	12.4	33.0	20	21	30.0	24.9	81.8
2	3	8.8	33.0	20	21	30.0	24.9	74.4
2	4	19.7	33.0	20	21	30.0	24.9	76.5
3	2	8.8	33.0	20	21	30.0	24.9	70.6
3	5	-20.2	33.0	20	21	30.0	24.9	65.2
4	2	21.7	33.0	20	21	30.0	24.9	75.6
4	6	9.5	33.0	20	21	30.0	24.9	75.6
4	7	21.4	33.0	20	21	30.0	24.9	59.2
5	3	-20.2	33.0	20	21	30.0	24.9	48.3
6	4	9.5	33.0	20	21	30.0	24.9	79.4
7	4	21.4	33.0	20	21	30.0	24.9	84.4
7	8	8.1	33.0	20	21	30.0	24.9	95.9
7	9	24.9	33.0	20	21	30.0	24.9	78.1
8	7	-6.9	33.0	20	21	30.0	24.9	84.8
9	7	12.9	33.0	20	21	30.0	24.9	82.2
9	10	5.8	33.0	20	21	30.0	24.9	83.9
9	11	23.8	33.0	20	21	30.0	24.9	80.6
10	9	0.8	33.0	20	21	30.0	24.9	75.1
11	9	8.8	33.0	20	21	30.0	24.9	82.0
11	12	8.1	33.0	20	21	30.0	24.9	73.0
11	13	18.3	33.0	20	21	30.0	24.9	49.5
12	11	8.1	33.0	20	21	30.0	24.9	82.6
13	11	18.3	33.0	20	21	30.0	24.9	87.6
13	14	10.7	33.0	20	21	30.0	24.9	73.9
13	15	21.9	33.0	20	21	30.0	24.9	72.6
14	13	10.7	33.0	20	21	30.0	24.9	77.5
15	13	21.9	33.0	20	21	30.0	24.9	88.5
15	16	0.3	33.0	20	21	30.0	24.9	79.3
15	17	1.1	33.0	20	21	30.0	24.9	62.9
16	15	0.3	33.0	20	21	30.0	24.9	62.6
17	15	1.1	33.0	20	21	30.0	24.9	79.6
18	19	30.0	24.9	20	21	30.0	24.9	74.8
19	18	30.0	24.9	20	21	30.0	24.9	74.8
21	20	30.0	24.9	20	21	30.0	24.9	-51.1
22	23	18.4	24.6	20	21	30.0	24.9	95.5
23	22	18.4	24.6	20	21	30.0	24.9	91.5
24	25	18.4	24.6	20	21	30.0	24.9	96.9
25	24	18.4	24.6	20	21	30.0	24.9	100.9

26	27	18.4	24.6	20	21	30.0	24.9	88.0
27	26	18.4	24.6	20	21	30.0	24.9	84.2
28	29	30.0	25.1	20	21	30.0	24.9	78.0
29	28	30.0	25.1	20	21	30.0	24.9	86.9
30	31	30.0	25.1	20	21	30.0	24.9	69.1
31	30	30.0	25.1	20	21	30.0	24.9	72.3
32	33	18.4	24.6	20	21	30.0	24.9	91.3
33	32	18.4	24.6	20	21	30.0	24.9	81.7
34	35	18.4	24.6	20	21	30.0	24.9	79.4
35	34	18.4	24.6	20	21	30.0	24.9	83.2
1	2	12.4	33.0	21	20	30.0	24.9	98.3
2	1	12.4	33.0	21	20	30.0	24.9	88.5
2	3	8.8	33.0	21	20	30.0	24.9	77.2
2	4	19.7	33.0	21	20	30.0	24.9	83.5
3	2	8.8	33.0	21	20	30.0	24.9	77.3
3	5	-20.2	33.0	21	20	30.0	24.9	72.1
4	2	21.7	33.0	21	20	30.0	24.9	82.3
4	6	9.5	33.0	21	20	30.0	24.9	82.6
4	7	21.4	33.0	21	20	30.0	24.9	54.1
5	3	-20.2	33.0	21	20	30.0	24.9	55.2
6	4	9.5	33.0	21	20	30.0	24.9	86.5
7	4	21.4	33.0	21	20	30.0	24.9	91.5
7	8	8.1	33.0	21	20	30.0	24.9	102.7
7	9	24.9	33.0	21	20	30.0	24.9	80.9
8	7	-6.9	33.0	21	20	30.0	24.9	91.7
9	7	12.9	33.0	21	20	30.0	24.9	89.1
9	10	5.8	33.0	21	20	30.0	24.9	90.8
9	11	23.8	33.0	21	20	30.0	24.9	87.3
10	9	0.8	33.0	21	20	30.0	24.9	81.9
11	9	8.8	33.0	21	20	30.0	24.9	88.9
11	12	8.1	33.0	21	20	30.0	24.9	79.8
11	13	18.3	33.0	21	20	30.0	24.9	68.2
12	11	8.1	33.0	21	20	30.0	24.9	83.4
13	11	18.3	33.0	21	20	30.0	24.9	94.4
13	14	10.7	33.0	21	20	30.0	24.9	80.6
13	15	21.9	33.0	21	20	30.0	24.9	79.2
14	13	10.7	33.0	21	20	30.0	24.9	84.2
15	13	21.9	33.0	21	20	30.0	24.9	95.2
15	16	0.3	33.0	21	20	30.0	24.9	86.0
15	17	1.1	33.0	21	20	30.0	24.9	69.5
16	15	0.3	33.0	21	20	30.0	24.9	69.2
17	15	1.1	33.0	21	20	30.0	24.9	86.2
18	19	30.0	24.9	21	20	30.0	24.9	85.0
19	18	30.0	24.9	21	20	30.0	24.9	84.7
20	21	30.0	24.9	21	20	30.0	24.9	-62.2
22	23	18.4	24.6	21	20	30.0	24.9	101.9
23	22	18.4	24.6	21	20	30.0	24.9	97.9
24	25	18.4	24.6	21	20	30.0	24.9	97.4
25	24	18.4	24.6	21	20	30.0	24.9	101.4
26	27	18.4	24.6	21	20	30.0	24.9	88.8
27	26	18.4	24.6	21	20	30.0	24.9	85.0
28	29	30.0	25.1	21	20	30.0	24.9	84.6
29	28	30.0	25.1	21	20	30.0	24.9	93.4
30	31	30.0	25.1	21	20	30.0	24.9	79.8
31	30	30.0	25.1	21	20	30.0	24.9	79.6
32	33	18.4	24.6	21	20	30.0	24.9	92.1
33	32	18.4	24.6	21	20	30.0	24.9	65.5
34	35	18.4	24.6	21	20	30.0	24.9	85.8
35	34	18.4	24.6	21	20	30.0	24.9	89.6
1	2	12.4	33.0	22	23	18.4	24.6	83.7
2	1	12.4	33.0	22	23	18.4	24.6	100.5
2	3	8.8	33.0	22	23	18.4	24.6	79.7
2	4	19.7	33.0	22	23	18.4	24.6	83.5
3	2	8.8	33.0	22	23	18.4	24.6	89.7
3	5	-20.2	33.0	22	23	18.4	24.6	57.8
4	2	21.7	33.0	22	23	18.4	24.6	94.7

4	6	9.5	33.0	22	23	18.4	24.6	96.3
4	7	21.4	33.0	22	23	18.4	24.6	94.0
5	3	-20.2	33.0	22	23	18.4	24.6	74.7
6	4	9.5	33.0	22	23	18.4	24.6	86.4
7	4	21.4	33.0	22	23	18.4	24.6	74.4
7	8	8.1	33.0	22	23	18.4	24.6	113.6
7	9	24.9	33.0	22	23	18.4	24.6	101.1
8	7	-6.9	33.0	22	23	18.4	24.6	88.6
9	7	12.9	33.0	22	23	18.4	24.6	73.0
9	10	5.8	33.0	22	23	18.4	24.6	96.2
9	11	23.8	33.0	22	23	18.4	24.6	96.5
10	9	0.8	33.0	22	23	18.4	24.6	85.1
11	9	8.8	33.0	22	23	18.4	24.6	78.1
11	12	8.1	33.0	22	23	18.4	24.6	86.9
11	13	18.3	33.0	22	23	18.4	24.6	91.2
12	11	8.1	33.0	22	23	18.4	24.6	70.6
13	11	18.3	33.0	22	23	18.4	24.6	75.5
13	14	10.7	33.0	22	23	18.4	24.6	85.0
13	15	21.9	33.0	22	23	18.4	24.6	83.9
14	13	10.7	33.0	22	23	18.4	24.6	69.1
15	13	21.9	33.0	22	23	18.4	24.6	91.2
15	16	0.3	33.0	22	23	18.4	24.6	59.6
15	17	1.1	33.0	22	23	18.4	24.6	79.2
16	15	0.3	33.0	22	23	18.4	24.6	79.9
17	15	1.1	33.0	22	23	18.4	24.6	62.9
18	19	30.0	24.9	22	23	18.4	24.6	102.0
19	18	30.0	24.9	22	23	18.4	24.6	102.6
20	21	30.0	24.9	22	23	18.4	24.6	102.6
21	20	30.0	24.9	22	23	18.4	24.6	96.1
X FOR DIST =			0.10000D+01					
X FOR DIST =			0.10000D+01					
23	22	18.4	24.6	22	23	18.4	24.6	-29.1
24	25	18.4	24.6	22	23	18.4	24.6	104.5
25	24	18.4	24.6	22	23	18.4	24.6	100.5
26	27	18.4	24.6	22	23	18.4	24.6	86.4
27	26	18.4	24.6	22	23	18.4	24.6	96.0
28	29	30.0	25.1	22	23	18.4	24.6	99.8
29	28	30.0	25.1	22	23	18.4	24.6	79.6
30	31	30.0	25.1	22	23	18.4	24.6	99.6
31	30	30.0	25.1	22	23	18.4	24.6	89.4
32	33	18.4	24.6	22	23	18.4	24.6	84.4
33	32	18.4	24.6	22	23	18.4	24.6	84.8
34	35	18.4	24.6	22	23	18.4	24.6	67.5
35	34	18.4	24.6	22	23	18.4	24.6	67.6
1	2	12.4	33.0	23	22	18.4	24.6	87.6
2	1	12.4	33.0	23	22	18.4	24.6	104.4
2	3	8.8	33.0	23	22	18.4	24.6	83.7
2	4	19.7	33.0	23	22	18.4	24.6	87.4
3	2	8.8	33.0	23	22	18.4	24.6	93.6
3	5	-20.2	33.0	23	22	18.4	24.6	61.7
4	2	21.7	33.0	23	22	18.4	24.6	98.7
4	6	9.5	33.0	23	22	18.4	24.6	100.2
4	7	21.4	33.0	23	22	18.4	24.6	97.9
5	3	-20.2	33.0	23	22	18.4	24.6	78.6
6	4	9.5	33.0	23	22	18.4	24.6	90.4
7	4	21.4	33.0	23	22	18.4	24.6	78.4
7	8	8.1	33.0	23	22	18.4	24.6	117.5
7	9	24.9	33.0	23	22	18.4	24.6	105.0
8	7	-6.9	33.0	23	22	18.4	24.6	92.5
9	7	12.9	33.0	23	22	18.4	24.6	76.9
9	10	5.8	33.0	23	22	18.4	24.6	100.1
9	11	23.8	33.0	23	22	18.4	24.6	100.5
10	9	0.8	33.0	23	22	18.4	24.6	89.0
11	9	8.8	33.0	23	22	18.4	24.6	82.0
11	12	8.1	33.0	23	22	18.4	24.6	90.8
11	13	18.3	33.0	23	22	18.4	24.6	95.1

12	11	8.1	33.0	23	22	18.4	24.6	74.5
13	11	18.3	33.0	23	22	18.4	24.6	79.5
13	14	10.7	33.0	23	22	18.4	24.6	89.0
13	15	21.9	33.0	23	22	18.4	24.6	83.9
14	13	10.7	33.0	23	22	18.4	24.6	73.1
15	13	21.9	33.0	23	22	18.4	24.6	95.1
15	16	0.3	33.0	23	22	18.4	24.6	63.6
15	17	1.1	33.0	23	22	18.4	24.6	79.2
16	15	0.3	33.0	23	22	18.4	24.6	79.9
17	15	1.1	33.0	23	22	18.4	24.6	62.9
18	19	30.0	24.9	23	22	18.4	24.6	106.0
19	18	30.0	24.9	23	22	18.4	24.6	106.6
20	21	30.0	24.9	23	22	18.4	24.6	106.5
21	20	30.0	24.9	23	22	18.4	24.6	100.1

X FOR DIST = 0.10000D+01

X FOR DIST = 0.10000D+01

22	23	18.4	24.6	23	22	.18.4	24.6	113.3
24	25	18.4	24.6	23	22	18.4	24.6	87.6
25	24	18.4	24.6	23	22	18.4	24.6	83.7
26	27	18.4	24.6	23	22	18.4	24.6	82.5
27	26	18.4	24.6	23	22	18.4	24.6	92.1
28	29	30.0	25.1	23	22	18.4	24.6	103.7
29	28	30.0	25.1	23	22	18.4	24.6	83.5
30	31	30.0	25.1	23	22	18.4	24.6	103.5
31	30	30.0	25.1	23	22	18.4	24.6	93.4
32	33	18.4	24.6	23	22	18.4	24.6	90.5
33	32	18.4	24.6	23	22	18.4	24.6	80.8
34	35	18.4	24.6	23	22	18.4	24.6	67.2
35	34	18.4	24.6	23	22	18.4	24.6	74.1
1	2	12.4	33.0	24	25	18.4	24.6	107.7
2	1	12.4	33.0	24	25	18.4	24.6	107.5
2	3	8.8	33.0	24	25	18.4	24.6	90.4
2	4	19.7	33.0	24	25	18.4	24.6	89.6
3	2	8.8	33.0	24	25	18.4	24.6	86.7
3	5	-20.2	33.0	24	25	18.4	24.6	71.4
4	2	21.7	33.0	24	25	18.4	24.6	91.7
4	6	9.5	33.0	24	25	18.4	24.6	102.6
4	7	21.4	33.0	24	25	18.4	24.6	100.5
5	3	-20.2	33.0	24	25	18.4	24.6	81.4
6	4	9.5	33.0	24	25	18.4	24.6	96.5
7	4	21.4	33.0	24	25	18.4	24.6	84.5
7	8	8.1	33.0	24	25	18.4	24.6	120.2
7	9	24.9	33.0	24	25	18.4	24.6	107.8
8	7	-6.9	33.0	24	25	18.4	24.6	95.2
9	7	12.9	33.0	24	25	18.4	24.6	75.5
9	10	5.8	33.0	24	25	18.4	24.6	103.0
9	11	23.8	33.0	24	25	18.4	24.6	109.2
10	9	0.8	33.0	24	25	18.4	24.6	97.8
11	9	6.8	33.0	24	25	18.4	24.6	55.8
11	12	8.1	33.0	24	25	18.4	24.6	88.1
11	13	18.3	33.0	24	25	18.4	24.6	98.4
12	11	8.1	33.0	24	25	18.4	24.6	84.3
13	11	18.3	33.0	24	25	18.4	24.6	89.2
13	14	10.7	33.0	24	25	18.4	24.6	83.3
13	15	21.9	33.0	24	25	18.4	24.6	96.6
14	13	10.7	33.0	24	25	18.4	24.6	93.4
15	13	21.9	33.0	24	25	18.4	24.6	59.4
15	16	0.3	33.0	24	25	18.4	24.6	87.0
15	17	1.1	33.0	24	25	18.4	24.6	80.3
16	15	0.3	33.0	24	25	18.4	24.6	80.7
17	15	1.1	33.0	24	25	18.4	24.6	86.7
18	19	30.0	24.9	24	25	18.4	24.6	108.7
19	18	30.0	24.9	24	25	18.4	24.6	70.2
20	21	30.0	24.9	24	25	18.4	24.6	107.7
21	20	30.0	24.9	24	25	18.4	24.6	107.2
22	23	18.4	24.6	24	25	18.4	24.6	85.3

23	22	18.4	24.6	24	25	18.4	24.6	102.2
25	24	18.4	24.6	24	25	18.4	24.6	-18.7
26	27	18.4	24.6	24	25	18.4	24.6	81.4
27	26	18.4	24.6	24	25	18.4	24.6	97.6
28	29	30.0	25.1	24	25	18.4	24.6	106.5
29	28	30.0	25.1	24	25	18.4	24.6	107.1
30	31	30.0	25.1	24	25	18.4	24.6	105.7
31	30	30.0	25.1	24	25	18.4	24.6	99.2
32	33	18.4	24.6	24	25	18.4	24.6	97.1
33	32	18.4	24.6	24	25	18.4	24.6	90.9
34	35	18.4	24.6	24	25	18.4	24.6	83.1
35	34	18.4	24.6	24	25	18.4	24.6	79.7
1	2	12.4	33.0	25	24	18.4	24.6	103.7
2	1	12.4	33.0	25	24	18.4	24.6	103.5
2	3	8.8	33.0	25	24	18.4	24.6	86.5
2	4	19.7	33.0	25	24	18.4	24.6	85.7
3	2	8.8	33.0	25	24	18.4	24.6	82.7
3	5	-20.2	33.0	25	24	18.4	24.6	67.5
4	2	21.7	33.0	25	24	18.4	24.6	87.7
4	6	9.5	33.0	25	24	18.4	24.6	98.7
4	7	21.4	33.0	25	24	18.4	24.6	96.6
5	3	-20.2	33.0	25	24	18.4	24.6	77.4
6	4	9.5	33.0	25	24	18.4	24.6	92.6
7	4	21.4	33.0	25	24	18.4	24.6	80.6
7	8	8.1	33.0	25	24	18.4	24.6	116.2
7	9	24.9	33.0	25	24	18.4	24.6	103.9
8	7	-6.9	33.0	25	24	18.4	24.6	91.2
9	7	12.9	33.0	25	24	18.4	24.6	71.6
9	10	5.8	33.0	25	24	18.4	24.6	99.0
9	11	23.8	33.0	25	24	18.4	24.6	105.3
10	9	0.8	33.0	25	24	18.4	24.6	93.9
11	9	8.8	33.0	25	24	18.4	24.6	51.9
11	12	8.1	33.0	25	24	18.4	24.6	84.2
11	13	18.3	33.0	25	24	18.4	24.6	94.5
12	11	8.1	33.0	25	24	18.4	24.6	80.4
13	11	18.3	33.0	25	24	18.4	24.6	85.3
13	14	10.7	33.0	25	24	18.4	24.6	79.4
13	15	21.9	33.0	25	24	18.4	24.6	92.7
14	13	10.7	33.0	25	24	18.4	24.6	89.5
15	13	21.9	33.0	25	24	18.4	24.6	55.5
15	16	0.3	33.0	25	24	18.4	24.6	83.1
15	17	1.1	33.0	25	24	18.4	24.6	76.4
16	15	0.3	33.0	25	24	18.4	24.6	76.8
17	15	1.1	33.0	25	24	18.4	24.6	82.7
18	19	30.0	24.9	25	24	18.4	24.6	104.7
19	18	30.0	24.9	25	24	18.4	24.6	66.2
20	21	30.0	24.9	25	24	18.4	24.6	103.7
21	20	30.0	24.9	25	24	18.4	24.6	103.2
22	23	18.4	24.6	25	24	18.4	24.6	89.3
23	22	18.4	24.6	25	24	18.4	24.6	106.1
24	25	18.4	24.6	25	24	18.4	24.6	-40.0
26	27	18.4	24.6	25	24	18.4	24.6	64.7
27	26	18.4	24.6	25	24	18.4	24.6	80.9
28	29	30.0	25.1	25	24	18.4	24.6	102.5
29	28	30.0	25.1	25	24	18.4	24.6	103.1
30	31	30.0	25.1	25	24	18.4	24.6	101.7
31	30	30.0	25.1	25	24	18.4	24.6	95.3
32	33	18.4	24.6	25	24	18.4	24.6	80.3
33	32	18.4	24.6	25	24	18.4	24.6	70.1
34	35	18.4	24.6	25	24	18.4	24.6	87.0
35	34	18.4	24.6	25	24	18.4	24.6	83.6
1	2	12.4	33.0	26	27	18.4	24.6	101.1
2	1	12.4	33.0	26	27	18.4	24.6	100.9
2	3	8.8	33.0	26	27	18.4	24.6	89.6
2	4	19.7	33.0	26	27	18.4	24.6	92.5
3	2	8.8	33.0	26	27	18.4	24.6	80.1

3	5	-20.2	33.0	26	27	18.4	24.6	74.6
4	2	21.7	33.0	26	27	18.4	24.6	85.2
4	6	9.5	33.0	26	27	18.4	24.6	85.6
4	7	21.4	33.0	26	27	18.4	24.6	87.3
5	3	-20.2	33.0	26	27	18.4	24.6	64.6
6	4	9.5	33.0	26	27	18.4	24.6	95.4
7	4	21.4	33.0	26	27	18.4	24.6	94.4
7	8	8.1	33.0	26	27	18.4	24.6	103.0
7	9	24.9	33.0	26	27	18.4	24.6	94.6
8	7	-6.9	33.0	26	27	18.4	24.6	98.0
9	7	12.9	33.0	26	27	18.4	24.6	89.4
9	10	5.8	33.0	26	27	18.4	24.6	78.8
9	11	23.8	33.0	26	27	18.4	24.6	101.8
10	9	0.8	33.0	26	27	18.4	24.6	90.6
11	9	8.8	33.0	26	27	18.4	24.6	87.5
11	12	8.1	33.0	26	27	18.4	24.6	77.0
11	13	18.3	33.0	26	27	18.4	24.6	89.3
12	11	8.1	33.0	26	27	18.4	24.6	86.9
13	11	18.3	33.0	26	27	18.4	24.6	91.9
13	14	10.7	33.0	26	27	18.4	24.6	80.9
13	15	21.9	33.0	26	27	18.4	24.6	87.6
14	13	10.7	33.0	26	27	18.4	24.6	90.3
15	13	21.9	33.0	26	27	18.4	24.6	85.4
15	16	0.3	33.0	26	27	18.4	24.6	83.4
15	17	1.1	33.0	26	27	18.4	24.6	73.7
16	15	0.3	33.0	26	27	18.4	24.6	73.6
17	15	1.1	33.0	26	27	18.4	24.6	83.6
18	19	30.0	24.9	26	27	18.4	24.6	102.8
19	18	30.0	24.9	26	27	18.4	24.6	82.4
20	21	30.0	24.9	26	27	18.4	24.6	101.4
21	20	30.0	24.9	26	27	18.4	24.6	100.7
22	23	18.4	24.6	26	27	18.4	24.6	103.8
23	22	18.4	24.6	26	27	18.4	24.6	107.8
24	25	18.4	24.6	26	27	18.4	24.6	91.0
25	24	18.4	24.6	26	27	18.4	24.6	107.7
27	26	18.4	24.6	26	27	18.4	24.6	-51.9
28	29	30.0	25.1	26	27	18.4	24.6	100.2
29	28	30.0	25.1	26	27	18.4	24.6	100.9
30	31	30.0	25.1	26	27	18.4	24.6	89.3
31	30	30.0	25.1	26	27	18.4	24.6	98.6
32	33	18.4	24.6	26	27	18.4	24.6	65.5
33	32	18.4	24.6	26	27	18.4	24.6	55.6
34	35	18.4	24.6	26	27	18.4	24.6	91.5
35	34	18.4	24.6	26	27	18.4	24.6	91.6
1	2	12.4	33.0	27	26	18.4	24.6	101.1
2	1	12.4	33.0	27	26	18.4	24.6	100.9
2	3	8.8	33.0	27	26	18.4	24.6	89.6
2	4	19.7	33.0	27	26	18.4	24.6	96.4
3	2	8.8	33.0	27	26	18.4	24.6	80.1
3	5	-20.2	33.0	27	26	18.4	24.6	74.5
4	2	21.7	33.0	27	26	18.4	24.6	85.1
4	6	9.5	33.0	27	26	18.4	24.6	85.5
4	7	21.4	33.0	27	26	18.4	24.6	87.3
5	3	-20.2	33.0	27	26	18.4	24.6	64.5
6	4	9.5	33.0	27	26	18.4	24.6	99.3
7	4	21.4	33.0	27	26	18.4	24.6	98.3
7	8	8.1	33.0	27	26	18.4	24.6	103.0
7	9	24.9	33.0	27	26	18.4	24.6	94.6
8	7	-6.9	33.0	27	26	18.4	24.6	97.9
9	7	12.9	33.0	27	26	18.4	24.6	89.3
9	10	5.8	33.0	27	26	18.4	24.6	78.8
9	11	23.8	33.0	27	26	18.4	24.6	101.9
10	9	0.8	33.0	27	26	18.4	24.6	90.6
11	9	8.8	33.0	27	26	18.4	24.6	87.5
11	12	8.1	33.0	27	26	18.4	24.6	77.1
11	13	18.3	33.0	27	26	18.4	24.6	85.5

12	11	8.1	33.0	27	26	18.4	24.6	86.9
13	11	18.3	33.0	27	26	18.4	24.6	91.9
13	14	10.7	33.0	27	26	18.4	24.6	77.1
13	15	21.9	33.0	27	26	18.4	24.6	84.0
14	13	10.7	33.0	27	26	18.4	24.6	86.5
15	13	21.9	33.0	27	26	18.4	24.6	81.5
15	16	0.3	33.0	27	26	18.4	24.6	79.8
15	17	1.1	33.0	27	26	18.4	24.6	70.2
16	15	0.3	33.0	27	26	18.4	24.6	70.0
17	15	1.1	33.0	27	26	18.4	24.6	80.0
18	19	30.0	24.9	27	26	18.4	24.6	102.8
19	18	30.0	24.9	27	26	18.4	24.6	82.3
20	21	30.0	24.9	27	26	18.4	24.6	105.2
21	20	30.0	24.9	27	26	18.4	24.6	104.5
22	23	18.4	24.6	27	26	18.4	24.6	94.3
23	22	18.4	24.6	27	26	18.4	24.6	98.2
24	25	18.4	24.6	27	26	18.4	24.6	74.8
25	24	18.4	24.6	27	26	18.4	24.6	91.6
26	27	18.4	24.6	27	26	18.4	24.6	-28.8
28	29	30.0	25.1	27	26	18.4	24.6	100.1
29	28	30.0	25.1	27	26	18.4	24.6	100.8
30	31	30.0	25.1	27	26	18.4	24.6	93.2
31	30	30.0	25.1	27	26	18.4	24.6	102.4
32	33	18.4	24.6	27	26	18.4	24.6	77.9
33	32	18.4	24.6	27	26	18.4	24.6	67.8
34	35	18.4	24.6	27	26	18.4	24.6	75.0
35	34	18.4	24.6	27	26	18.4	24.6	82.1
1	2	12.4	33.0	28	29	30.0	25.1	61.5
2	1	12.4	33.0	28	29	30.0	25.1	23.3
2	3	8.8	33.0	28	29	30.0	25.1	68.5
2	4	19.7	33.0	28	29	30.0	25.1	71.8
3	2	8.8	33.0	28	29	30.0	25.1	44.5
3	5	-20.2	33.0	28	29	30.0	25.1	57.3
4	2	21.7	33.0	28	29	30.0	25.1	45.5
4	6	9.5	33.0	28	29	30.0	25.1	78.1
4	7	21.4	33.0	28	29	30.0	25.1	76.3
5	3	-20.2	33.0	28	29	30.0	25.1	53.4
6	4	9.5	33.0	28	29	30.0	25.1	74.7
7	4	21.4	33.0	28	29	30.0	25.1	77.7
7	8	8.1	33.0	28	29	30.0	25.1	95.9
7	9	24.9	33.0	28	29	30.0	25.1	78.9
8	7	-6.9	33.0	28	29	30.0	25.1	80.9
9	7	12.9	33.0	28	29	30.0	25.1	82.3
9	10	5.8	33.0	28	29	30.0	25.1	90.6
9	11	23.8	33.0	28	29	30.0	25.1	59.9
10	9	0.8	33.0	28	29	30.0	25.1	58.9
11	9	8.8	33.0	28	29	30.0	25.1	82.9
11	12	8.1	33.0	28	29	30.0	25.1	53.3
11	13	18.3	33.0	28	29	30.0	25.1	59.1
12	11	8.1	33.0	28	29	30.0	25.1	77.9
13	11	18.3	33.0	28	29	30.0	25.1	88.9
13	14	10.7	33.0	28	29	30.0	25.1	48.4
13	15	21.9	33.0	28	29	30.0	25.1	32.0
14	13	10.7	33.0	28	29	30.0	25.1	58.1
15	13	21.9	33.0	28	29	30.0	25.1	69.1
15	16	0.3	33.0	28	29	30.0	25.1	75.8
15	17	1.1	33.0	28	29	30.0	25.1	51.4
16	15	0.3	33.0	28	29	30.0	25.1	51.0
17	15	1.1	33.0	28	29	30.0	25.1	55.0
18	19	30.0	24.9	28	29	30.0	25.1	75.5
19	18	30.0	24.9	28	29	30.0	25.1	62.5
20	21	30.0	24.9	28	29	30.0	25.1	91.7
21	20	30.0	24.9	28	29	30.0	25.1	85.1
22	23	18.4	24.6	28	29	30.0	25.1	77.1
23	22	18.4	24.6	28	29	30.0	25.1	73.2
24	25	18.4	24.6	28	29	30.0	25.1	95.0

25	24	18.4	24.6	28	29	30.0	25.1	99.0
26	27	18.4	24.6	28	29	30.0	25.1	82.6
27	26	18.4	24.6	28	29	30.0	25.1	82.7
29	28	30.0	25.1	28	29	30.0	25.1	-33.8
30	31	30.0	25.1	28	29	30.0	25.1	77.2
31	30	30.0	25.1	28	29	30.0	25.1	71.7
32	33	18.4	24.6	28	29	30.0	25.1	89.9
33	32	18.4	24.6	28	29	30.0	25.1	63.5
34	35	18.4	24.6	28	29	30.0	25.1	61.3
35	34	18.4	24.6	28	29	30.0	25.1	71.0
1	2	12.4	33.0	29	28	30.0	25.1	84.3
2	1	12.4	33.0	29	28	30.0	25.1	46.6
2	3	8.8	33.0	29	28	30.0	25.1	65.2
2	4	19.7	33.0	29	28	30.0	25.1	63.4
3	2	8.8	33.0	29	28	30.0	25.1	67.3
3	5	-20.2	33.0	29	28	30.0	25.1	54.0
4	2	21.7	33.0	29	28	30.0	25.1	68.3
4	6	9.5	33.0	29	28	30.0	25.1	75.3
4	7	21.4	33.0	29	28	30.0	25.1	74.1
5	3	-20.2	33.0	29	28	30.0	25.1	50.1
6	4	9.5	33.0	29	28	30.0	25.1	66.4
7	4	21.4	33.0	29	28	30.0	25.1	69.4
7	8	8.1	33.0	29	28	30.0	25.1	97.7
7	9	24.9	33.0	29	28	30.0	25.1	77.0
8	7	-6.9	33.0	29	28	30.0	25.1	78.7
9	7	12.9	33.0	29	28	30.0	25.1	80.1
9	10	5.8	33.0	29	28	30.0	25.1	88.6
9	11	23.8	33.0	29	28	30.0	25.1	70.2
10	9	0.8	33.0	29	28	30.0	25.1	45.0
11	9	8.8	33.0	29	28	30.0	25.1	81.0
11	12	8.1	33.0	29	28	30.0	25.1	72.6
11	13	18.3	33.0	29	28	30.0	25.1	78.6
12	11	8.1	33.0	29	28	30.0	25.1	76.2
13	11	18.3	33.0	29	28	30.0	25.1	81.2
13	14	10.7	33.0	29	28	30.0	25.1	74.0
13	15	21.9	33.0	29	28	30.0	25.1	51.8
14	13	10.7	33.0	29	28	30.0	25.1	77.6
15	13	21.9	33.0	29	28	30.0	25.1	88.7
15	16	0.3	33.0	29	28	30.0	25.1	74.6
15	17	1.1	33.0	29	28	30.0	25.1	71.2
16	15	0.3	33.0	29	28	30.0	25.1	70.9
17	15	1.1	33.0	29	28	30.0	25.1	74.9
18	19	30.0	24.9	29	28	30.0	25.1	75.2
19	18	30.0	24.9	29	28	30.0	25.1	51.2
20	21	30.0	24.9	29	28	30.0	25.1	82.8
21	20	30.0	24.9	29	28	30.0	25.1	76.2
22	23	18.4	24.6	29	28	30.0	25.1	97.3
23	22	18.4	24.6	29	28	30.0	25.1	93.3
24	25	18.4	24.6	29	28	30.0	25.1	94.4
25	24	18.4	24.6	29	28	30.0	25.1	98.4
26	27	18.4	24.6	29	28	30.0	25.1	81.9
27	26	18.4	24.6	29	28	30.0	25.1	82.0
28	29	30.0	25.1	29	28	30.0	25.1	-57.8
30	31	30.0	25.1	29	28	30.0	25.1	65.2
31	30	30.0	25.1	29	28	30.0	25.1	63.3
32	33	18.4	24.6	29	28	30.0	25.1	83.3
33	32	18.4	24.6	29	28	30.0	25.1	44.8
34	35	18.4	24.6	29	28	30.0	25.1	81.6
35	34	18.4	24.6	29	28	30.0	25.1	85.2
1	2	12.4	33.0	30	31	30.0	25.1	80.4
2	1	12.4	33.0	30	31	30.0	25.1	70.9
2	3	8.8	33.0	30	31	30.0	25.1	59.2
2	4	19.7	33.0	30	31	30.0	25.1	64.7
3	2	8.8	33.0	30	31	30.0	25.1	59.4
3	5	-20.2	33.0	30	31	30.0	25.1	57.9
4	2	21.7	33.0	30	31	30.0	25.1	64.4

4	6	9.5	33.0	30	31	30.0	25.1	67.7
4	7	21.4	33.0	30	31	30.0	25.1	53.3
5	3	-20.2	33.0	30	31	30.0	25.1	37.2
6	4	9.5	33.0	30	31	30.0	25.1	67.7
7	4	21.4	33.0	30	31	30.0	25.1	76.6
7	8	8.1	33.0	30	31	30.0	25.1	90.0
7	9	24.9	33.0	30	31	30.0	25.1	51.0
8	7	-6.9	33.0	30	31	30.0	25.1	79.0
9	7	12.9	33.0	30	31	30.0	25.1	76.4
9	10	5.8	33.0	30	31	30.0	25.1	84.8
9	11	23.8	33.0	30	31	30.0	25.1	75.9
10	9	0.8	33.0	30	31	30.0	25.1	70.0
11	9	8.8	33.0	30	31	30.0	25.1	77.0
11	12	8.1	33.0	30	31	30.0	25.1	68.6
11	13	18.3	33.0	30	31	30.0	25.1	63.4
12	11	8.1	33.0	30	31	30.0	25.1	72.0
13	11	18.3	33.0	30	31	30.0	25.1	83.0
13	14	10.7	33.0	30	31	30.0	25.1	69.9
13	15	21.9	33.0	30	31	30.0	25.1	69.1
14	13	10.7	33.0	30	31	30.0	25.1	73.4
15	13	21.9	33.0	30	31	30.0	25.1	84.4
15	16	0.3	33.0	30	31	30.0	25.1	75.8
15	17	1.1	33.0	30	31	30.0	25.1	59.6
16	15	0.3	33.0	30	31	30.0	25.1	66.2
17	15	1.1	33.0	30	31	30.0	25.1	76.2
18	19	30.0	24.9	30	31	30.0	25.1	65.7
19	18	30.0	24.9	30	31	30.0	25.1	53.0
20	21	30.0	24.9	30	31	30.0	25.1	79.6
21	20	30.0	24.9	30	31	30.0	25.1	72.4
22	23	18.4	24.6	30	31	30.0	25.1	88.7
23	22	18.4	24.6	30	31	30.0	25.1	84.8
24	25	18.4	24.6	30	31	30.0	25.1	89.0
25	24	18.4	24.6	30	31	30.0	25.1	92.9
26	27	18.4	24.6	30	31	30.0	25.1	86.0
27	26	18.4	24.6	30	31	30.0	25.1	82.2
28	29	30.0	25.1	30	31	30.0	25.1	65.1
29	28	30.0	25.1	30	31	30.0	25.1	73.5
31	30	30.0	25.1	30	31	30.0	25.1	-49.8
32	33	18.4	24.6	30	31	30.0	25.1	89.3
33	32	18.4	24.6	30	31	30.0	25.1	72.8
34	35	18.4	24.6	30	31	30.0	25.1	72.9
35	34	18.4	24.6	30	31	30.0	25.1	76.6
1	2	12.4	33.0	31	30	30.0	25.1	90.9
2	1	12.4	33.0	31	30	30.0	25.1	70.5
2	3	8.8	33.0	31	30	30.0	25.1	70.3
2	4	19.7	33.0	31	30	30.0	25.1	62.8
3	2	8.8	33.0	31	30	30.0	25.1	73.9
3	5	-20.2	33.0	31	30	30.0	25.1	59.0
4	2	21.7	33.0	31	30	30.0	25.1	74.9
4	6	9.5	33.0	31	30	30.0	25.1	79.5
4	7	21.4	33.0	31	30	30.0	25.1	70.5
5	3	-20.2	33.0	31	30	30.0	25.1	55.2
6	4	9.5	33.0	31	30	30.0	25.1	65.7
7	4	21.4	33.0	31	30	30.0	25.1	74.7
7	8	8.1	33.0	31	30	30.0	25.1	97.2
7	9	24.9	33.0	31	30	30.0	25.1	70.0
8	7	-6.9	33.0	31	30	30.0	25.1	82.2
9	7	12.9	33.0	31	30	30.0	25.1	83.5
9	10	5.8	33.0	31	30	30.0	25.1	91.7
9	11	23.8	33.0	31	30	30.0	25.1	60.8
10	9	0.8	33.0	31	30	30.0	25.1	70.0
11	9	8.8	33.0	31	30	30.0	25.1	84.0
11	12	8.1	33.0	31	30	30.0	25.1	75.3
11	13	18.3	33.0	31	30	30.0	25.1	74.1
12	11	8.1	33.0	31	30	30.0	25.1	78.9
13	11	18.3	33.0	31	30	30.0	25.1	89.9

13	14	10.7	33.0	31	30	30.0	25.1	76.5
13	15	21.9	33.0	31	30	30.0	25.1	65.8
14	13	10.7	33.0	31	30	30.0	25.1	80.1
15	13	21.9	33.0	31	30	30.0	25.1	91.1
15	16	0.3	33.0	31	30	30.0	25.1	76.5
15	17	1.1	33.0	31	30	30.0	25.1	73.1
16	15	0.3	33.0	31	30	30.0	25.1	72.8
17	15	1.1	33.0	31	30	30.0	25.1	82.8
18	19	30.0	24.9	31	30	30.0	25.1	78.7
19	18	30.0	24.9	31	30	30.0	25.1	76.4
20	21	30.0	24.9	31	30	30.0	25.1	79.8
21	20	30.0	24.9	31	30	30.0	25.1	69.1
22	23	18.4	24.6	31	30	30.0	25.1	98.9
23	22	18.4	24.6	31	30	30.0	25.1	94.9
24	25	18.4	24.6	31	30	30.0	25.1	95.4
25	24	18.4	24.6	31	30	30.0	25.1	99.4
26	27	18.4	24.6	31	30	30.0	25.1	76.8
27	26	18.4	24.6	31	30	30.0	25.1	72.9
28	29	30.0	25.1	31	30	30.0	25.1	66.9
29	28	30.0	25.1	31	30	30.0	25.1	79.0
30	31	30.0	25.1	31	30	30.0	25.1	-59.5
32	33	18.4	24.6	31	30	30.0	25.1	80.1
33	32	18.4	24.6	31	30	30.0	25.1	59.6
34	35	18.4	24.6	31	30	30.0	25.1	83.0
35	34	18.4	24.6	31	30	30.0	25.1	86.7
1	2	12.4	33.0	32	33	18.4	24.6	72.4
2	1	12.4	33.0	32	33	18.4	24.6	72.2
2	3	8.8	33.0	32	33	18.4	24.6	60.9
2	4	19.7	33.0	32	33	18.4	24.6	75.6
3	2	8.8	33.0	32	33	18.4	24.6	44.4
3	5	-20.2	33.0	32	33	18.4	24.6	45.8
4	2	21.7	33.0	32	33	18.4	24.6	56.4
4	6	9.5	33.0	32	33	18.4	24.6	68.8
4	7	21.4	33.0	32	33	18.4	24.6	58.7
5	3	-20.2	33.0	32	33	18.4	24.6	35.8
6	4	9.5	33.0	32	33	18.4	24.6	78.6
7	4	21.4	33.0	32	33	18.4	24.6	77.5
7	8	8.1	33.0	32	33	18.4	24.6	74.3
7	9	24.9	33.0	32	33	18.4	24.6	78.0
8	7	-6.9	33.0	32	33	18.4	24.6	69.3
9	7	12.9	33.0	32	33	18.4	24.6	60.7
9	10	5.8	33.0	32	33	18.4	24.6	62.2
9	11	23.8	33.0	32	33	18.4	24.6	79.4
10	9	0.8	33.0	32	33	18.4	24.6	74.0
11	9	8.8	33.0	32	33	18.4	24.6	71.0
11	12	8.1	33.0	32	33	18.4	24.6	66.7
11	13	18.3	33.0	32	33	18.4	24.6	75.2
12	11	8.1	33.0	32	33	18.4	24.6	70.5
13	11	18.3	33.0	32	33	18.4	24.6	75.5
13	14	10.7	33.0	32	33	18.4	24.6	70.8
13	15	21.9	33.0	32	33	18.4	24.6	84.9
14	13	10.7	33.0	32	33	18.4	24.6	80.2
15	13	21.9	33.0	32	33	18.4	24.6	75.2
15	16	0.3	33.0	32	33	18.4	24.6	73.7
15	17	1.1	33.0	32	33	18.4	24.6	71.2
16	15	0.3	33.0	32	33	18.4	24.6	71.0
17	15	1.1	33.0	32	33	18.4	24.6	80.9
18	19	30.0	24.9	32	33	18.4	24.6	85.9
19	18	30.0	24.9	32	33	18.4	24.6	69.5
20	21	30.0	24.9	32	33	18.4	24.6	84.2
21	20	30.0	24.9	32	33	18.4	24.6	100.4
22	23	18.4	24.6	32	33	18.4	24.6	94.9
23	22	18.4	24.6	32	33	18.4	24.6	98.9
24	25	18.4	24.6	32	33	18.4	24.6	82.5
25	24	18.4	24.6	32	33	18.4	24.6	103.3
26	27	18.4	24.6	32	33	18.4	24.6	70.1

27	26	18.4	24.6	32	33	18.4	24.6	57.9
28	29	30.0	25.1	32	33	18.4	24.6	65.4
29	28	30.0	25.1	32	33	18.4	24.6	84.0
30	31	30.0	25.1	32	33	18.4	24.6	78.4
31	30	30.0	25.1	32	33	18.4	24.6	91.5

X FOR DIST = 0.10000D+01
X FOR DIST = 0.10000D+01

33	32	18.4	24.6	32	33	18.4	24.6	84.9
34	35	18.4	24.6	32	33	18.4	24.6	82.6
35	34	18.4	24.6	32	33	18.4	24.6	82.7
1	2	12.4	33.0	33	32	18.4	24.6	110.7
2	1	12.4	33.0	33	32	18.4	24.6	110.5
2	3	8.8	33.0	33	32	18.4	24.6	99.2
2	4	19.7	33.0	33	32	18.4	24.6	101.9
3	2	8.8	33.0	33	32	18.4	24.6	82.8
3	5	-20.2	33.0	33	32	18.4	24.6	84.1
4	2	21.7	33.0	33	32	18.4	24.6	94.8
4	6	9.5	33.0	33	32	18.4	24.6	95.1
4	7	21.4	33.0	33	32	18.4	24.6	96.9
5	3	-20.2	33.0	33	32	18.4	24.6	74.1
6	4	9.5	33.0	33	32	18.4	24.6	104.8
7	4	21.4	33.0	33	32	18.4	24.6	103.8
7	8	8.1	33.0	33	32	18.4	24.6	112.5
7	9	24.9	33.0	33	32	18.4	24.6	104.2
8	7	-6.9	33.0	33	32	18.4	24.6	107.5
9	7	12.9	33.0	33	32	18.4	24.6	98.9
9	10	5.8	33.0	33	32	18.4	24.6	88.4
9	11	23.8	33.0	33	32	18.4	24.6	105.5
10	9	0.8	33.0	33	32	18.4	24.6	100.2
11	9	8.8	33.0	33	32	18.4	24.6	97.1
11	12	8.1	33.0	33	32	18.4	24.6	86.9
11	13	18.3	33.0	33	32	18.4	24.6	91.3
12	11	8.1	33.0	33	32	18.4	24.6	96.6
13	11	18.3	33.0	33	32	18.4	24.6	101.5
13	14	10.7	33.0	33	32	18.4	24.6	87.0
13	15	21.9	33.0	33	32	18.4	24.6	94.0
14	13	10.7	33.0	33	32	18.4	24.6	96.3
15	13	21.9	33.0	33	32	18.4	24.6	91.3
15	16	0.3	33.0	33	32	18.4	24.6	89.7
15	17	1.1	33.0	33	32	18.4	24.6	80.3
16	15	0.3	33.0	33	32	18.4	24.6	80.0
17	15	1.1	33.0	33	32	18.4	24.6	90.0
18	19	30.0	24.9	33	32	18.4	24.6	112.5
19	18	30.0	24.9	33	32	18.4	24.6	96.1
20	21	30.0	24.9	33	32	18.4	24.6	110.8
21	20	30.0	24.9	33	32	18.4	24.6	110.0
22	23	18.4	24.6	33	32	18.4	24.6	104.6
23	22	18.4	24.6	33	32	18.4	24.6	98.5
24	25	18.4	24.6	33	32	18.4	24.6	92.8
25	24	18.4	24.6	33	32	18.4	24.6	109.5
26	27	18.4	24.6	33	32	18.4	24.6	80.2
27	26	18.4	24.6	33	32	18.4	24.6	67.8
28	29	30.0	25.1	33	32	18.4	24.6	103.8
29	28	30.0	25.1	33	32	18.4	24.6	110.4
30	31	30.0	25.1	33	32	18.4	24.6	98.9
31	30	30.0	25.1	33	32	18.4	24.6	108.0

X FOR DIST = 0.10000D+01
X FOR DIST = 0.10000D+01

32	33	18.4	24.6	33	32	18.4	24.6	-54.2
34	35	18.4	24.6	33	32	18.4	24.6	92.3
35	34	18.4	24.6	33	32	18.4	24.6	92.4
1	2	12.4	33.0	34	35	18.4	24.6	88.3
2	1	12.4	33.0	34	35	18.4	24.6	105.1
2	3	8.8	33.0	34	35	18.4	24.6	84.4
2	4	19.7	33.0	34	35	18.4	24.6	88.1
3	2	8.8	33.0	34	35	18.4	24.6	94.4

3	5	-20.2	33.0	34	35	18.4	24.6	62.4
4	2	21.7	33.0	34	35	18.4	24.6	99.4
4	6	9.5	33.0	34	35	18.4	24.6	100.9
4	7	21.4	33.0	34	35	18.4	24.6	98.7
5	3	-20.2	33.0	34	35	18.4	24.6	79.3
6	4	9.5	33.0	34	35	18.4	24.6	91.0
7	4	21.4	33.0	34	35	18.4	24.6	79.0
7	8	8.1	33.0	34	35	18.4	24.6	118.3
7	9	24.9	33.0	34	35	18.4	24.6	105.9
8	7	-6.9	33.0	34	35	18.4	24.6	93.3
9	7	12.9	33.0	34	35	18.4	24.6	77.7
9	10	5.8	33.0	34	35	18.4	24.6	101.0
9	11	23.8	33.0	34	35	18.4	24.6	101.4
10	9	0.8	33.0	34	35	18.4	24.6	89.9
11	9	8.8	33.0	34	35	18.4	24.6	82.9
11	12	8.1	33.0	34	35	18.4	24.6	91.8
11	13	18.3	33.0	34	35	18.4	24.6	96.2
12	11	8.1	33.0	34	35	18.4	24.6	75.4
13	11	18.3	33.0	34	35	18.4	24.6	80.4
13	14	10.7	33.0	34	35	18.4	24.6	90.2
13	15	21.9	33.0	34	35	18.4	24.6	89.0
14	13	10.7	33.0	34	35	18.4	24.6	74.2
15	13	21.9	33.0	34	35	18.4	24.6	96.2
15	16	0.3	33.0	34	35	18.4	24.6	64.6
15	17	1.1	33.0	34	35	18.4	24.6	84.4
16	15	0.3	33.0	34	35	18.4	24.6	85.0
17	15	1.1	33.0	34	35	18.4	24.6	68.0
18	19	30.0	24.9	34	35	18.4	24.6	112.5
19	18	30.0	24.9	34	35	18.4	24.6	113.0
20	21	30.0	24.9	34	35	18.4	24.6	106.9
21	20	30.0	24.9	34	35	18.4	24.6	100.5
22	23	18.4	24.6	34	35	18.4	24.6	86.8
23	22	18.4	24.6	34	35	18.4	24.6	80.2
24	25	18.4	24.6	34	35	18.4	24.6	94.6
25	24	18.4	24.6	34	35	18.4	24.6	90.7
26	27	18.4	24.6	34	35	18.4	24.6	82.9
27	26	18.4	24.6	34	35	18.4	24.6	92.5
28	29	30.0	25.1	34	35	18.4	24.6	104.3
29	28	30.0	25.1	34	35	18.4	24.6	90.1
30	31	30.0	25.1	34	35	18.4	24.6	104.0
31	30	30.0	25.1	34	35	18.4	24.6	93.9
32	33	18.4	24.6	34	35	18.4	24.6	90.9
33	32	18.4	24.6	34	35	18.4	24.6	81.3

X FOR DIST = 0.10000D+01
X FOR DIST = 0.10000D+01

35	34	18.4	24.6	34	35	18.4	24.6	92.7
1	2	12.4	33.0	35	34	18.4	24.6	84.7
2	1	12.4	33.0	35	34	18.4	24.6	101.5
2	3	8.8	33.0	35	34	18.4	24.6	80.8
2	4	19.7	33.0	35	34	18.4	24.6	84.4
3	2	8.8	33.0	35	34	18.4	24.6	90.8
3	5	-20.2	33.0	35	34	18.4	24.6	58.8
4	2	21.7	33.0	35	34	18.4	24.6	95.8
4	6	9.5	33.0	35	34	18.4	24.6	97.2
4	7	21.4	33.0	35	34	18.4	24.6	95.0
5	3	-20.2	33.0	35	34	18.4	24.6	75.7
6	4	9.5	33.0	35	34	18.4	24.6	87.3
7	4	21.4	33.0	35	34	18.4	24.6	69.3
7	8	8.1	33.0	35	34	18.4	24.6	114.7
7	9	24.9	33.0	35	34	18.4	24.6	102.2
8	7	-6.9	33.0	35	34	18.4	24.6	89.7
9	7	12.9	33.0	35	34	18.4	24.6	74.0
9	10	5.8	33.0	35	34	18.4	24.6	97.3
9	11	23.8	33.0	35	34	18.4	24.6	97.7
10	9	0.8	33.0	35	34	18.4	24.6	86.2
11	9	8.8	33.0	35	34	18.4	24.6	79.2

```
11 12    8.1  33.0       35 34    18.4  24.6           88.2
11 13   18.3  33.0       35 34    18.4  24.6           92.5
12 11    8.1  33.0       35 34    18.4  24.6           71.8
13 11   18.3  33.0       35 34    18.4  24.6           72.7
13 14   10.7  33.0       35 34    18.4  24.6           86.6
13 15   21.9  33.0       35 34    18.4  24.6           85.3
14 13   10.7  33.0       35 34    18.4  24.6           70.5
15 13   21.9  33.0       35 34    18.4  24.6           92.6
15 16    0.3  33.0       35 34    18.4  24.6           54.9
15 17    1.1  33.0       35 34    18.4  24.6           80.6
16 15    0.3  33.0       35 34    18.4  24.6           81.3
17 15    1.1  33.0       35 34    18.4  24.6           60.3
18 19   30.0  24.9       35 34    18.4  24.6          102.8
19 18   30.0  24.9       35 34    18.4  24.6           96.4
20 21   30.0  24.9       35 34    18.4  24.6          103.1
21 20   30.0  24.9       35 34    18.4  24.6           96.7
22 23   18.4  24.6       35 34    18.4  24.6           79.8
23 22   18.4  24.6       35 34    18.4  24.6           80.1
24 25   18.4  24.6       35 34    18.4  24.6           98.1
25 24   18.4  24.6       35 34    18.4  24.6           94.1
26 27   18.4  24.6       35 34    18.4  24.6           75.8
27 26   18.4  24.6       35 34    18.4  24.6           92.4
28 29   30.0  25.1       35 34    18.4  24.6          100.7
29 28   30.0  25.1       35 34    18.4  24.6           80.4
30 31   30.0  25.1       35 34    18.4  24.6          100.3
31 30   30.0  25.1       35 34    18.4  24.6           90.2
32 33   18.4  24.6       35 34    18.4  24.6           90.9
33 32   18.4  24.6       35 34    18.4  24.6           81.2
X FOR DIST =   0.10000D+01
X FOR DIST =   0.10000D+01
34 35   18.4  24.6       35 34    18.4  24.6          -43.0
STOP --
```

APPENDIX C

The results presented in this section describe the extent to which two microwave signals will interfere with each other assuming free-space propagation characteristics. The results may be used for both inter- and intra-system interference analysis. A column-by-column description of the data follows.

COLUMN 1: The transmitting node designation for the intended path.

COLUMN 2: The receiving node designation for the intended path.

COLUMN 3: The power in dBm of the node identified in COLUMN 1.

COLUMN 4: The gain in dB of the transmitting antenna at the node identified in COLUMN 1.

COLUMN 5: The transmitting node designation source.

COLUMN 6: The receiving node designation associated with the node identified in COLUMN 5.

COLUMN 7: The power in dBm of the node identified in COLUMN 5.

COLUMN 8: The gain in dB of the receiving antenna at the node identified in COLUMN 6.

COLUMN 9: The carrier-to-interference ratio in dB for the combination defined in COLUMNS 1-8.

For the data presented in this section, the node designations 1 through 17 correspond to the proposed VEC nodes defined in Table 2-1 and the node designations 18-35 correspond to existing nodes which are co- or adjacent-channel to the proposed VEC trunk links. Nodes 18-35 are defined in Table 4-8.

```
RUN 1XCAA.SAV
INPUT FROM TTY (0) OR FILE (1)?
1
```

INTENDED SIGNAL				INTERFERING SIGNAL				CARRIER/ INTERF. RATIO
FR	TO	POWER	GAIN	FR	TO	POWER	GAIN	
2	1	12.4	33.0	1	2	12.4	33.0	-48.8
2	3	8.8	33.0	1	2	12.4	33.0	46.5
2	4	21.7	33.0	1	2	12.4	33.0	50.4
3	2	8.8	33.0	1	2	12.4	33.0	28.0
3	5	-20.2	33.0	1	2	12.4	33.0	39.9
4	2	21.7	33.0	1	2	12.4	33.0	33.0
4	6	9.5	33.0	1	2	12.4	33.0	76.4
4	7	21.4	33.0	1	2	12.4	33.0	76.9
5	3	-20.2	33.0	1	2	12.4	33.0	48.4
6	4	9.5	33.0	1	2	12.4	33.0	61.4
7	4	21.4	33.0	1	2	12.4	33.0	67.4
7	8	8.1	33.0	1	2	12.4	33.0	100.4
7	9	16.9	33.0	1	2	12.4	33.0	80.2
8	7	-6.9	33.0	1	2	12.4	33.0	81.5
9	7	16.9	33.0	1	2	12.4	33.0	80.9
9	10	5.8	33.0	1	2	12.4	33.0	92.5
9	11	8.8	33.0	1	2	12.4	33.0	66.3
10	9	0.8	33.0	1	2	12.4	33.0	49.2
11	9	8.8	33.0	1	2	12.4	33.0	85.2
11	12	8.1	33.0	1	2	12.4	33.0	77.9
11	13	18.3	33.0	1	2	12.4	33.0	84.6
12	11	8.1	33.0	1	2	12.4	33.0	81.4
13	11	18.3	33.0	1	2	12.4	33.0	86.3
13	14	10.7	33.0	1	2	12.4	33.0	80.2
13	15	21.9	33.0	1	2	12.4	33.0	58.8
14	13	10.7	33.0	1	2	12.4	33.0	83.6
15	13	21.9	33.0	1	2	12.4	33.0	94.6
15	16	0.3	33.0	1	2	12.4	33.0	81.4
15	17	1.1	33.0	1	2	12.4	33.0	78.3
16	15	0.3	33.0	1	2	12.4	33.0	77.8
17	15	1.1	33.0	1	2	12.4	33.0	81.8
18	19	18.4	24.6	1	2	12.4	33.0	89.0
19	18	18.4	24.6	1	2	12.4	33.0	85.3
20	21	30.0	24.6	1	2	12.4	33.0	112.1
21	20	30.0	24.6	1	2	12.4	33.0	102.4
22	23	30.0	24.2	1	2	12.4	33.0	66.7
23	22	30.0	24.2	1	2	12.4	33.0	82.6
24	25	30.4	25.1	1	2	12.4	33.0	64.4
25	24	30.4	25.1	1	2	12.4	33.0	91.3
26	27	30.4	25.1	1	2	12.4	33.0	89.5
27	26	30.4	25.1	1	2	12.4	33.0	96.1
28	29	30.4	25.1	1	2	12.4	33.0	62.0
29	28	30.4	25.1	1	2	12.4	33.0	80.5
30	31	31.8	24.7	1	2	12.4	33.0	76.7
31	30	31.8	24.7	1	2	12.4	33.0	62.4
32	33	31.8	24.7	1	2	12.4	33.0	80.6
33	32	31.8	24.7	1	2	12.4	33.0	74.7
34	35	30.4	24.7	1	2	12.4	33.0	82.3
35	34	30.4	24.7	1	2	12.4	33.0	95.3
1	2	12.4	33.0	2	1	12.4	33.0	-25.8
2	3	8.8	33.0	2	1	12.4	33.0	35.4
2	4	21.7	33.0	2	1	12.4	33.0	48.3
3	2	8.8	33.0	2	1	12.4	33.0	-46.7
3	5	-20.2	33.0	2	1	12.4	33.0	50.2
4	2	21.7	33.0	2	1	12.4	33.0	-28.7

4	6	9.5	33.0	2	1	12.4	33.0	86.2
4	7	21.4	33.0	2	1	12.4	33.0	78.0
5	3	-20.2	33.0	2	1	12.4	33.0	53.3
6	4	9.5	33.0	2	1	12.4	33.0	67.3
7	4	21.4	33.0	2	1	12.4	33.0	77.2
7	8	8.1	33.0	2	1	12.4	33.0	101.6
7	9	16.9	33.0	2	1	12.4	33.0	74.1
8	7	-6.9	33.0	2	1	12.4	33.0	82.7
9	7	16.9	33.0	2	1	12.4	33.0	82.1
9	10	5.8	33.0	2	1	12.4	33.0	93.5
9	11	8.8	33.0	2	1	12.4	33.0	67.1
10	9	0.8	33.0	2	1	12.4	33.0	50.1
11	9	8.8	33.0	2	1	12.4	33.0	86.1
11	12	8.1	33.0	2	1	12.4	33.0	78.6
11	13	18.3	33.0	2	1	12.4	33.0	46.2
12	11	8.1	33.0	2	1	12.4	33.0	82.1
13	11	18.3	33.0	2	1	12.4	33.0	87.1
13	14	10.7	33.0	2	1	12.4	33.0	53.7
13	15	21.9	33.0	2	1	12.4	33.0	32.2
14	13	10.7	33.0	2	1	12.4	33.0	45.2
15	13	21.9	33.0	2	1	12.4	33.0	56.2
15	16	0.3	33.0	2	1	12.4	33.0	81.8
15	17	1.1	33.0	2	1	12.4	33.0	39.7
16	15	0.3	33.0	2	1	12.4	33.0	51.2
17	15	1.1	33.0	2	1	12.4	33.0	55.2
18	19	18.4	24.6	2	1	12.4	33.0	95.2
19	18	18.4	24.6	2	1	12.4	33.0	91.5
20	21	30.0	24.6	2	1	12.4	33.0	112.2
21	20	30.0	24.6	2	1	12.4	33.0	102.6
22	23	30.0	24.2	2	1	12.4	33.0	66.8
23	22	30.0	24.2	2	1	12.4	33.0	88.8
24	25	30.4	25.1	2	1	12.4	33.0	94.2
25	24	30.4	25.1	2	1	12.4	33.0	101.0
26	27	30.4	25.1	2	1	12.4	33.0	99.3
27	26	30.4	25.1	2	1	12.4	33.0	105.9
28	29	30.4	25.1	2	1	12.4	33.0	72.2
29	28	30.4	25.1	2	1	12.4	33.0	96.5
30	31	31.8	24.7	2	1	12.4	33.0	96.4
31	30	31.8	24.7	2	1	12.4	33.0	72.5
32	33	31.8	24.7	2	1	12.4	33.0	103.0
33	32	31.8	24.7	2	1	12.4	33.0	91.1
34	35	30.4	24.7	2	1	12.4	33.0	78.5
35	34	30.4	24.7	2	1	12.4	33.0	94.5
1	2	12.4	33.0	2	3	8.8	33.0	-32.2
2	1	12.4	33.0	2	3	8.8	33.0	42.6
2	4	21.7	33.0	2	3	8.8	33.0	34.9
3	2	8.8	33.0	2	3	8.8	33.0	-53.1
3	5	-20.2	33.0	2	3	8.8	33.0	26.8
4	2	21.7	33.0	2	3	8.8	33.0	-65.1
4	6	9.5	33.0	2	3	8.8	33.0	72.8
4	7	21.4	33.0	2	3	8.8	33.0	64.6
5	3	-20.2	33.0	2	3	8.8	33.0	17.9
6	4	9.5	33.0	2	3	8.8	33.0	53.9
7	4	21.4	33.0	2	3	8.8	33.0	63.8
7	8	8.1	33.0	2	3	8.8	33.0	95.2
7	9	16.9	33.0	2	3	8.8	33.0	67.7
8	7	-6.9	33.0	2	3	8.8	33.0	69.3
9	7	16.9	33.0	2	3	8.8	33.0	68.7
9	10	5.8	33.0	2	3	8.8	33.0	87.1
9	11	8.8	33.0	2	3	8.8	33.0	60.7
10	9	0.8	33.0	2	3	8.8	33.0	43.7
11	9	8.8	33.0	2	3	8.8	33.0	79.7
11	12	8.1	33.0	2	3	8.8	33.0	72.2
11	13	18.3	33.0	2	3	8.8	33.0	86.8
12	11	8.1	33.0	2	3	8.8	33.0	75.7
13	11	18.3	33.0	2	3	8.8	33.0	80.7

```
13 14   10.7  33.0        2   3    8.8  33.0          84.3
13 15   21.9  33.0        2   3    8.8  33.0          62.8
14 13   10.7  33.0        2   3    8.8  33.0          87.8
15 13   21.9  33.0        2   3    8.8  33.0          98.8
15 16    0.3  33.0        2   3    8.8  33.0          75.4
15 17    1.1  33.0        2   3    8.8  33.0          82.3
16 15    0.3  33.0        2   3    8.8  33.0          81.8
17 15    1.1  33.0        2   3    8.8  33.0          85.8
18 19   18.4  24.6        2   3    8.8  33.0          81.8
19 18   18.4  24.6        2   3    8.8  33.0          78.1
20 21   30.0  24.6        2   3    8.8  33.0         105.8
21 20   30.0  24.6        2   3    8.8  33.0          96.2
22 23   30.0  24.2        2   3    8.8  33.0          60.4
23 22   30.0  24.2        2   3    8.8  33.0          75.4
24 25   30.4  25.1        2   3    8.8  33.0          87.8
25 24   30.4  25.1        2   3    8.8  33.0          94.6
26 27   30.4  25.1        2   3    8.8  33.0          92.9
27 26   30.4  25.1        2   3    8.8  33.0          99.5
28 29   30.4  25.1        2   3    8.8  33.0          75.8
29 28   30.4  25.1        2   3    8.8  33.0          94.1
30 31   31.8  24.7        2   3    8.8  33.0          90.0
31 30   31.8  24.7        2   3    8.8  33.0          66.1
32 33   31.8  24.7        2   3    8.8  33.0          98.6
33 32   31.8  24.7        2   3    8.8  33.0          84.7
34 35   30.4  24.7        2   3    8.8  33.0          92.1
35 34   30.4  24.7        2   3    8.8  33.0         108.1
 1  2   12.4  33.0        2   4   21.7  33.0         -62.1
 2  1   12.4  33.0        2   4   21.7  33.0          29.7
 2  3    8.8  33.0        2   4   21.7  33.0           9.1
 3  2    8.8  33.0        2   4   21.7  33.0         -83.0
 3  5  -20.2  33.0        2   4   21.7  33.0          23.9
X FOR DIST =   0.10000D+01
X FOR DIST =   0.10000D+01
 4  2   21.7  33.0        2   4   21.7  33.0         -95.0
X FOR DIST =   0.10000D+01
X FOR DIST =   0.10000D+01
 4  6    9.5  33.0        2   4   21.7  33.0          37.9
X FOR DIST =   0.10000D+01
X FOR DIST =   0.10000D+01
 4  7   21.4  33.0        2   4   21.7  33.0          58.7
 5  3  -20.2  33.0        2   4   21.7  33.0          27.0
X FOR DIST =   0.10000D+01
X FOR DIST =   0.10000D+01
 6  4    9.5  33.0        2   4   21.7  33.0          19.0
X FOR DIST =   0.10000D+01
X FOR DIST =   0.10000D+01
 7  4   21.4  33.0        2   4   21.7  33.0          28.9
 7  8    8.1  33.0        2   4   21.7  33.0          82.3
 7  9   16.9  33.0        2   4   21.7  33.0          54.8
 8  7   -6.9  33.0        2   4   21.7  33.0          63.4
 9  7   16.9  33.0        2   4   21.7  33.0          62.8
 9 10    5.8  33.0        2   4   21.7  33.0          74.2
 9 11    8.8  33.0        2   4   21.7  33.0          47.8
10  9    0.8  33.0        2   4   21.7  33.0          30.8
11  9    8.8  33.0        2   4   21.7  33.0          66.8
11 12    8.1  33.0        2   4   21.7  33.0          59.3
11 13   18.3  33.0        2   4   21.7  33.0          75.9
12 11    8.1  33.0        2   4   21.7  33.0          62.8
13 11   18.3  33.0        2   4   21.7  33.0          67.8
13 14   10.7  33.0        2   4   21.7  33.0          71.4
13 15   21.9  33.0        2   4   21.7  33.0          49.9
14 13   10.7  33.0        2   4   21.7  33.0          74.9
15 13   21.9  33.0        2   4   21.7  33.0          85.9
15 16    0.3  33.0        2   4   21.7  33.0          62.5
15 17    1.1  33.0        2   4   21.7  33.0          69.4
16 15    0.3  33.0        2   4   21.7  33.0          68.9
```

17	15	1.1	33.0	2	4	21.7	33.0	72.9
18	19	18.4	24.6	2	4	21.7	33.0	75.9
19	18	18.4	24.6	2	4	21.7	33.0	72.2
20	21	30.0	24.6	2	4	21.7	33.0	92.9
21	20	30.0	24.6	2	4	21.7	33.0	83.3
22	23	30.0	24.2	2	4	21.7	33.0	47.5
23	22	30.0	24.2	2	4	21.7	33.0	69.5
24	25	30.4	25.1	2	4	21.7	33.0	74.9
25	24	30.4	25.1	2	4	21.7	33.0	81.7
26	27	30.4	25.1	2	4	21.7	33.0	80.0
27	26	30.4	25.1	2	4	21.7	33.0	86.6
28	29	30.4	25.1	2	4	21.7	33.0	56.9
29	28	30.4	25.1	2	4	21.7	33.0	81.2
30	31	31.8	24.7	2	4	21.7	33.0	77.1
31	30	31.8	24.7	2	4	21.7	33.0	53.2
32	33	31.8	24.7	2	4	21.7	33.0	81.7
33	32	31.8	24.7	2	4	21.7	33.0	71.8
34	35	30.4	24.7	2	4	21.7	33.0	79.2
35	34	30.4	24.7	2	4	21.7	33.0	95.2
1	2	12.4	33.0	3	2	8.8	33.0	50.0
2	1	12.4	33.0	3	2	8.8	33.0	61.0
2	3	8.8	33.0	3	2	8.8	33.0	-31.4
2	4	21.7	33.0	3	2	8.8	33.0	64.3
3	5	-20.2	33.0	3	2	8.8	33.0	4.0
4	2	21.7	33.0	3	2	8.8	33.0	27.0
4	6	9.5	33.0	3	2	8.8	33.0	79.5
4	7	21.4	33.0	3	2	8.8	33.0	78.6
5	3	-20.2	33.0	3	2	8.8	33.0	-56.5
6	4	9.5	33.0	3	2	8.8	33.0	60.2
7	4	21.4	33.0	3	2	8.8	33.0	71.2
7	8	8.1	33.0	3	2	8.8	33.0	102.2
7	9	16.9	33.0	3	2	8.8	33.0	76.2
8	[illegible]	-6.9	33.0	3	2	8.8	33.0	83.2
9	[illegible]	16.9	33.0	3	2	8.8	33.0	88.6
[illegible]	[illegible]	5.8	33.0	3	2	8.8	33.0	93.4
[illegible]	[illegible]	8.8	33.0	3	2	8.8	33.0	51.5
10	[illegible]	0.8	33.0	3	2	8.8	33.0	70.2
11	[illegible]	8.8	33.0	3	2	8.8	33.0	[illegible]
[illegible]	[illegible]	8.1	33.0	3	2	8.8	33.0	[illegible]
[illegible]	13	15.3	33.0	3	2	8.8	33.0	73.1
12	11	8.1	33.0	3	2	8.8	33.0	84.6
13	11	15.3	33.0	3	2	8.8	33.0	[illegible]
13	14	10.7	33.0	3	2	8.8	33.0	78.0
13	15	21.9	33.0	3	2	8.8	33.0	68.3
14	13	10.7	33.0	3	2	8.8	33.0	61.1
15	13	21.9	33.0	3	2	8.8	33.0	[illegible]
15	16	0.3	33.0	3	2	8.8	33.0	76.8
[illegible]	[illegible]	1.1	33.0	3	2	8.8	33.0	[illegible]
16	[illegible]	0.3	33.0	3	2	8.8	[illegible]	[illegible]
[illegible]	[illegible]	1.1	33.0	3	2	8.8	33.0	[illegible]
18	19	18.4	24.6	3	2	8.8	33.0	[illegible]
19	18	18.4	24.6	3	2	8.8	33.0	94.5
20	21	30.0	24.6	3	2	8.8	33.0	[illegible]
21	20	30.0	24.6	3	2	8.8	33.0	[illegible]
22	23	30.0	24.2	3	2	8.8	33.0	90.1
23	22	30.0	24.2	3	2	8.8	33.0	[illegible]
24	25	30.4	25.1	3	2	8.8	33.0	91.2
25	[illegible]	30.4	25.1	3	2	8.8	33.0	94.3
[illegible]	[illegible]	[illegible]	25.1	3	2	8.8	33.0	[illegible]
[illegible]	26	30.4	25.1	3	2	8.8	[illegible]	[illegible]
[illegible]	[illegible]	30.4	25.1	3	2	8.8	33.0	[illegible]
[illegible]	[illegible]	30.4	25.1	3	2	8.8	[illegible]	[illegible]
30	[illegible]	31.8	24.7	3	2	8.8	33.0	[illegible]
[illegible]	[illegible]	31.8	24.7	3	2	8.8	33.0	[illegible]
[illegible]	[illegible]	[illegible]	24.7	3	2	8.8	33.0	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

34	33	30.4	24.7	3	2	8.8	33.0	[illegible]
35	34	30.4	24.7	3	2	8.8	33.0	98.4
1	2	12.4	33.0	3	5	-20.2	33.0	112.0
2	1	12.4	33.0	3	5	-20.2	33.0	107.0
2	3	8.8	33.0	3	5	-20.2	33.0	-12.4
2	4	21.7	33.0	3	5	-20.2	33.0	82.3
3	2	8.8	33.0	3	5	-20.2	33.0	62.0
4	2	21.7	33.0	3	5	-20.2	33.0	89.0
4	6	9.5	33.0	3	5	-20.2	33.0	87.3
4	7	21.4	33.0	3	5	-20.2	33.0	101.6
5	3	-20.2	33.0	3	5	-20.2	33.0	-37.5
6	4	9.5	33.0	3	5	-20.2	33.0	83.2
7	4	21.4	33.0	3	5	-20.2	33.0	89.2
7	8	8.1	33.0	3	5	-20.2	33.0	125.2
7	9	16.9	33.0	3	5	-20.2	33.0	99.2
8	7	-6.9	33.0	3	5	-20.2	33.0	106.2
9	7	16.9	33.0	3	5	-20.2	33.0	111.6
9	10	5.8	33.0	3	5	-20.2	33.0	118.4
9	11	8.8	33.0	3	5	-20.2	33.0	74.5
10	9	0.8	33.0	3	5	-20.2	33.0	93.2
11	9	8.8	33.0	3	5	-20.2	33.0	111.2
11	12	8.1	33.0	3	5	-20.2	33.0	110.4
11	13	18.3	33.0	3	5	-20.2	33.0	110.1
12	11	8.1	33.0	3	5	-20.2	33.0	107.6
13	11	18.3	33.0	3	5	-20.2	33.0	116.5
13	14	10.7	33.0	3	5	-20.2	33.0	113.0
13	15	21.9	33.0	3	5	-20.2	33.0	103.3
14	13	10.7	33.0	3	5	-20.2	33.0	116.1
15	13	21.9	33.0	3	5	-20.2	33.0	127.1
15	16	0.3	33.0	3	5	-20.2	33.0	113.8
15	17	1.1	33.0	3	5	-20.2	33.0	110.9
16	15	0.3	33.0	3	5	-20.2	33.0	110.3
17	15	1.1	33.0	3	5	-20.2	33.0	120.3
18	19	18.4	24.6	3	5	-20.2	33.0	117.2
19	18	18.4	24.6	3	5	-20.2	33.0	113.5
20	21	30.0	24.6	3	5	-20.2	33.0	[illegible]
21	20	30.0	24.6	3	5	-20.2	33.0	[illegible]
22	23	30.0	24.2	3	5	-20.2	33.0	89.1
23	22	30.0	[illegible]	3	5	-20.2	33.0	110.8
24	25	30.4	25.1	3	5	-20.2	33.0	[illegible]
25	24	30.4	25.1	3	5	-20.2	33.0	116.3
26	27	30.4	25.1	3	5	-20.2	33.0	[illegible]
27	26	30.4	25.1	3	5	-20.2	33.0	117.5
28	29	30.4	25.1	3	5	-20.2	33.0	84.4
29	28	30.4	25.1	3	5	-20.2	33.0	121.1
30	31	31.8	24.7	3	5	-20.2	33.0	120.1
31	30	31.8	24.7	3	5	-20.2	33.0	[illegible]
32	33	31.8	24.7	3	5	-20.2	33.0	[illegible]
33	32	31.8	24.7	3	5	-20.2	33.0	[illegible]
34	35	30.4	24.7	3	5	-20.2	33.0	131.4
35	34	30.4	24.7	3	5	-20.2	33.0	137.4
1	2	12.4	33.0	4	2	21.7	33.0	[illegible]
2	1	12.4	33.0	4	2	21.7	33.0	[illegible]
2	3	8.8	33.0	4	2	21.7	33.0	[illegible]

X FOR DIST = 0.10000D+01
Y FOR DIST = 0.10000D+01

2	4	21.7	33.0	4	2	21.7	33.0	57.4
3	2	8.8	33.0	4	2	21.7	33.0	17.0
[illegible]	[illegible]	[illegible]	33.0	4	2	21.7	[illegible]	[illegible]

X FOR DIST = 0.10000D+01
Y FOR DIST = 0.10000D+01

[illegible]	[illegible]	[illegible]	33.0	4	2	21.7	33.0	[illegible]

X FOR DIST = 0.10000D+01
Y FOR DIST = 0.10000D+01

4	7	[illegible]	33.0	4	2	21.7	33.0	[illegible]
5	3	-20.2	33.0	4	2	21.7	[illegible]	[illegible]

```
X FOR DIST =    0.10000D+01
X FOR DIST =    0.10000D+01
 6  4     9.5  33.0         4  2    21.7  33.0         58.3
X FOR DIST =    0.10000D+01
X FOR DIST =    0.10000D+01
 7  4    21.4  33.0         4  2    21.7  33.0         57.3
 7  8     8.1  33.0         4  2    21.7  33.0         77.4
 7  9    16.9  33.0         4  2    21.7  33.0         44.7
 8  7    -6.9  33.0         4  2    21.7  33.0         66.3
 9  7    16.9  33.0         4  2    21.7  33.0         67.7
 9 10     5.8  33.0         4  2    21.7  33.0         74.2
 9 11     8.8  33.0         4  2    21.7  33.0         51.6
10  9     0.8  33.0         4  2    21.7  33.0         59.7
11  9     8.8  33.0         4  2    21.7  33.0         66.7
11 12     8.1  33.0         4  2    21.7  33.0         59.8
11 13    18.3  33.0         4  2    21.7  33.0         55.2
12 11     8.1  33.0         4  2    21.7  33.0         62.7
13 11    18.3  33.0         4  2    21.7  33.0         73.6
13 14    10.7  33.0         4  2    21.7  33.0         62.2
13 15    21.9  33.0         4  2    21.7  33.0         62.0
14 13    10.7  33.0         4  2    21.7  33.0         65.2
15 13    21.9  33.0         4  2    21.7  33.0         76.2
15 16     0.3  33.0         4  2    21.7  33.0         68.4
15 17     1.1  33.0         4  2    21.7  33.0         52.6
16 15     0.3  33.0         4  2    21.7  33.0         59.0
17 15     1.1  33.0         4  2    21.7  33.0         69.0
18 19    18.4  24.6         4  2    21.7  33.0         90.8
19 18    18.4  24.6         4  2    21.7  33.0         81.2
20 21    30.0  24.6         4  2    21.7  33.0        102.4
21 20    30.0  24.6         4  2    21.7  33.0         92.8
22 23    30.0  24.2         4  2    21.7  33.0         45.0
23 22    30.0  24.2         4  2    21.7  33.0         78.5
24 25    30.4  25.1         4  2    21.7  33.0         76.5
25 24    30.4  25.1         4  2    21.7  33.0         84.1
26 27    30.4  25.1         4  2    21.7  33.0         82.7
27 26    30.4  25.1         4  2    21.7  33.0         89.5
28 29    30.4  25.1         4  2    21.7  33.0         61.6
29 28    30.4  25.1         4  2    21.7  33.0         80.7
30 31    31.8  24.7         4  2    21.7  33.0         72.6
31 30    31.8  24.7         4  2    21.7  33.0         80.1
32 33    31.8  24.7         4  2    21.7  33.0         71.6
33 32    31.8  24.7         4  2    21.7  33.0         74.7
34 35    30.4  24.7         4  2    21.7  33.0         70.6
35 34    30.4  24.7         4  2    21.7  33.0         86.6
 1  2    12.4  33.0         4  6     9.5  33.0         75.2
 2  1    12.4  33.0         4  6     9.5  33.0         69.3
 2  3     8.8  33.0         4  6     9.5  33.0         58.6
X FOR DIST =    0.10000D+01
X FOR DIST =    0.10000D+01
 2  4    21.7  33.0         4  6     9.5  33.0         69.6
 3  2     8.8  33.0         4  6     9.5  33.0         47.2
 3  5   -20.2  33.0         4  6     9.5  33.0         48.4
X FOR DIST =    0.10000D+01
X FOR DIST =    0.10000D+01
 4  2    21.7  33.0         4  6     9.5  33.0         30.2
X FOR DIST =    0.10000D+01
X FOR DIST =    0.10000D+01
 4  7    21.4  33.0         4  6     9.5  33.0         40.9
 5  3   -20.2  33.0         4  6     9.5  33.0         32.5
X FOR DIST =    0.10000D+01
X FOR DIST =    0.10000D+01
 6  4     9.5  33.0         4  6     9.5  33.0         70.5
X FOR DIST =    0.10000D+01
X FOR DIST =    0.10000D+01
 7  4    21.4  33.0         4  6     9.5  33.0         69.5
 7  8     8.1  33.0         4  6     9.5  33.0         89.6
```

7	9	16.9	33.0	4	6	9.5	33.0	56.9
8	7	-6.9	33.0	4	6	9.5	33.0	78.5
9	7	16.9	33.0	4	6	9.5	33.0	79.9
9	10	5.8	33.0	4	6	9.5	33.0	86.4
9	11	8.8	33.0	4	6	9.5	33.0	63.8
10	9	0.8	33.0	4	6	9.5	33.0	71.9
11	9	8.8	33.0	4	6	9.5	33.0	78.9
11	12	8.1	33.0	4	6	9.5	33.0	72.0
11	13	18.3	33.0	4	6	9.5	33.0	67.4
12	11	8.1	33.0	4	6	9.5	33.0	74.9
13	11	18.3	33.0	4	6	9.5	33.0	85.8
13	14	10.7	33.0	4	6	9.5	33.0	74.4
13	15	21.9	33.0	4	6	9.5	33.0	74.2
14	13	10.7	33.0	4	6	9.5	33.0	77.4
15	13	21.9	33.0	4	6	9.5	33.0	88.4
15	16	0.3	33.0	4	6	9.5	33.0	80.6
15	17	1.1	33.0	4	6	9.5	33.0	64.8
16	15	0.3	33.0	4	6	9.5	33.0	71.2
17	15	1.1	33.0	4	6	9.5	33.0	81.2
18	19	18.4	24.6	4	6	9.5	33.0	103.0
19	18	18.4	24.6	4	6	9.5	33.0	93.4
20	21	30.0	24.6	4	6	9.5	33.0	114.6
21	20	30.0	24.6	4	6	9.5	33.0	105.0
22	23	30.0	24.2	4	6	9.5	33.0	57.2
23	22	30.0	24.2	4	6	9.5	33.0	90.7
24	25	30.4	25.1	4	6	9.5	33.0	88.7
25	24	30.4	25.1	4	6	9.5	33.0	96.3
26	27	30.4	25.1	4	6	9.5	33.0	94.9
27	26	30.4	25.1	4	6	9.5	33.0	101.7
28	29	30.4	25.1	4	6	9.5	33.0	73.8
29	28	30.4	25.1	4	6	9.5	33.0	85.9
30	31	31.8	24.7	4	6	9.5	33.0	84.8
31	30	31.8	24.7	4	6	9.5	33.0	92.3
32	33	31.8	24.7	4	6	9.5	33.0	83.8
33	32	31.8	24.7	4	6	9.5	33.0	86.9
34	35	30.4	24.7	4	6	9.5	33.0	82.8
35	34	30.4	24.7	4	6	9.5	33.0	98.8
1	2	12.4	33.0	4	7	21.4	33.0	74.3
2	1	12.4	33.0	4	7	21.4	33.0	64.4
2	3	8.8	33.0	4	7	21.4	33.0	53.7
X FOR DIST =			0.10000D+01					
X FOR DIST =			0.10000D+01					
2	4	21.7	33.0	4	7	21.4	33.0	64.7
3	2	8.8	33.0	4	7	21.4	33.0	46.3
3	5	-20.2	33.0	4	7	21.4	33.0	43.5
X FOR DIST =			0.10000D+01					
X FOR DIST =			0.10000D+01					
4	2	21.7	33.0	4	7	21.4	33.0	29.3
X FOR DIST =			0.10000D+01					
X FOR DIST =			0.10000D+01					
4	6	9.5	33.0	4	7	21.4	33.0	17.1
5	3	-20.2	33.0	4	7	21.4	33.0	27.6
X FOR DIST =			0.10000D+01					
X FOR DIST =			0.10000D+01					
6	4	9.5	33.0	4	7	21.4	33.0	65.6
X FOR DIST =			0.10000D+01					
X FOR DIST =			0.10000D+01					
7	4	21.4	33.0	4	7	21.4	33.0	64.6
7	8	8.1	33.0	4	7	21.4	33.0	48.7
7	9	16.9	33.0	4	7	21.4	33.0	26.0
8	7	-6.9	33.0	4	7	21.4	33.0	37.6
9	7	16.9	33.0	4	7	21.4	33.0	39.0
9	10	5.8	33.0	4	7	21.4	33.0	45.5
9	11	8.8	33.0	4	7	21.4	33.0	34.9
10	9	0.8	33.0	4	7	21.4	33.0	43.0
11	9	8.8	33.0	4	7	21.4	33.0	50.0

11	12	8.1	33.0	4	7	21.4	33.0	31.1
11	13	18.3	33.0	4	7	21.4	33.0	38.5
12	11	8.1	33.0	4	7	21.4	33.0	46.0
13	11	18.3	33.0	4	7	21.4	33.0	56.9
13	14	10.7	33.0	4	7	21.4	33.0	33.5
13	15	21.9	33.0	4	7	21.4	33.0	51.3
14	13	10.7	33.0	4	7	21.4	33.0	48.5
15	13	21.9	33.0	4	7	21.4	33.0	59.5
15	16	0.3	33.0	4	7	21.4	33.0	61.7
15	17	1.1	33.0	4	7	21.4	33.0	41.9
16	15	0.3	33.0	4	7	21.4	33.0	48.3
17	15	1.1	33.0	4	7	21.4	33.0	58.3
18	19	18.4	24.6	4	7	21.4	33.0	91.1
19	18	18.4	24.6	4	7	21.4	33.0	81.5
20	21	30.0	24.6	4	7	21.4	33.0	102.7
21	20	30.0	24.6	4	7	21.4	33.0	93.1
22	23	30.0	24.2	4	7	21.4	33.0	45.3
23	22	30.0	24.2	4	7	21.4	33.0	78.8
24	25	30.4	25.1	4	7	21.4	33.0	82.8
25	24	30.4	25.1	4	7	21.4	33.0	90.4
26	27	30.4	25.1	4	7	21.4	33.0	89.0
27	26	30.4	25.1	4	7	21.4	33.0	95.8
28	29	30.4	25.1	4	7	21.4	33.0	65.9
29	28	30.4	25.1	4	7	21.4	33.0	85.0
30	31	31.8	24.7	4	7	21.4	33.0	76.9
31	30	31.8	24.7	4	7	21.4	33.0	84.4
32	33	31.8	24.7	4	7	21.4	33.0	81.9
33	32	31.8	24.7	4	7	21.4	33.0	85.0
34	35	30.4	24.7	4	7	21.4	33.0	70.9
35	34	30.4	24.7	4	7	21.4	33.0	86.9
1	2	12.4	33.0	5	3	-20.2	33.0	108.9
2	1	12.4	33.0	5	3	-20.2	33.0	98.5
2	3	8.8	33.0	5	3	-20.2	33.0	48.1
2	4	21.7	33.0	5	3	-20.2	33.0	94.2
3	2	8.8	33.0	5	3	-20.2	33.0	70.9
3	5	-20.2	33.0	5	3	-20.2	33.0	-22.2
4	2	21.7	33.0	5	3	-20.2	33.0	85.9
4	6	9.5	33.0	5	3	-20.2	33.0	112.7
4	7	21.4	33.0	5	3	-20.2	33.0	107.9
6	4	9.5	33.0	5	3	-20.2	33.0	99.2
7	4	21.4	33.0	5	3	-20.2	33.0	105.2
7	8	8.1	33.0	5	3	-20.2	33.0	127.5
7	9	16.9	33.0	5	3	-20.2	33.0	91.5
8	7	-6.9	33.0	5	3	-20.2	33.0	132.5
9	7	16.9	33.0	5	3	-20.2	33.0	117.9
9	10	5.8	33.0	5	3	-20.2	33.0	114.7
9	11	8.8	33.0	5	3	-20.2	33.0	70.7
10	9	0.8	33.0	5	3	-20.2	33.0	87.5
11	9	8.8	33.0	5	3	-20.2	33.0	107.4
11	12	8.1	33.0	5	3	-20.2	33.0	100.7
11	13	18.3	33.0	5	3	-20.2	33.0	100.3
12	11	8.1	33.0	5	3	-20.2	33.0	103.6
13	11	18.3	33.0	5	3	-20.2	33.0	114.8
13	14	10.7	33.0	5	3	-20.2	33.0	103.2
13	15	21.9	33.0	5	3	-20.2	33.0	93.4
14	13	10.7	33.0	5	3	-20.2	33.0	106.3
15	13	21.9	33.0	5	3	-20.2	33.0	117.3
15	16	0.3	33.0	5	3	-20.2	33.0	104.0
15	17	1.1	33.0	5	3	-20.2	33.0	101.0
16	15	0.3	33.0	5	3	-20.2	33.0	100.5
17	15	1.1	33.0	5	3	-20.2	33.0	110.4
18	19	18.4	24.6	5	3	-20.2	33.0	127.2
19	18	18.4	24.6	5	3	-20.2	33.0	123.5
20	21	30.0	24.6	5	3	-20.2	33.0	144.5
21	20	30.0	24.6	5	3	-20.2	33.0	134.9
22	23	30.0	24.2	5	3	-20.2	33.0	99.1

23	22	30.0	24.2	5	3	-20.2	33.0	120.6
24	25	30.4	25.1	5	3	-20.2	33.0	126.0
25	24	30.4	25.1	5	3	-20.2	33.0	133.1
26	27	30.4	25.1	5	3	-20.2	33.0	131.5
27	26	30.4	25.1	5	3	-20.2	33.0	138.2
28	29	30.4	25.1	5	3	-20.2	33.0	84.4
29	28	30.4	25.1	5	3	-20.2	33.0	121.0
30	31	31.8	24.7	5	3	-20.2	33.0	123.8
31	30	31.8	24.7	5	3	-20.2	33.0	109.3
32	33	31.8	24.7	5	3	-20.2	33.0	127.8
33	32	31.8	24.7	5	3	-20.2	33.0	123.5
34	35	30.4	24.7	5	3	-20.2	33.0	82.6
35	34	30.4	24.7	5	3	-20.2	33.0	98.6
1	2	12.4	33.0	6	4	9.5	33.0	94.1
2	1	12.4	33.0	6	4	9.5	33.0	84.3
2	3	8.8	33.0	6	4	9.5	33.0	72.6
X FOR DIST =		0.10000D+01						
X FOR DIST =		0.10000D+01						
2	4	21.7	33.0	6	4	9.5	33.0	17.0
3	2	8.8	33.0	6	4	9.5	33.0	66.1
3	5	-20.2	33.0	6	4	9.5	33.0	61.9
X FOR DIST =		0.10000D+01						
X FOR DIST =		0.10000D+01						
4	2	21.7	33.0	6	4	9.5	33.0	49.1
X FOR DIST =		0.10000D+01						
X FOR DIST =		0.10000D+01						
4	6	9.5	33.0	6	4	9.5	33.0	-61.9
X FOR DIST =		0.10000D+01						
X FOR DIST =		0.10000D+01						
4	7	21.4	33.0	6	4	9.5	33.0	68.7
5	3	-20.2	33.0	6	4	9.5	33.0	36.6
X FOR DIST =		0.10000D+01						
X FOR DIST =		0.10000D+01						
7	4	21.4	33.0	6	4	9.5	33.0	28.0
7	8	8.1	33.0	6	4	9.5	33.0	99.4
7	9	16.9	33.0	6	4	9.5	33.0	54.9
8	7	-6.9	33.0	6	4	9.5	33.0	88.4
9	7	16.9	33.0	6	4	9.5	33.0	89.7
9	10	5.8	33.0	6	4	9.5	33.0	96.3
9	11	8.8	33.0	6	4	9.5	33.0	69.8
10	9	0.6	33.0	6	4	9.5	33.0	74.9
11	9	6.8	33.0	6	4	9.5	33.0	88.8
11	12	8.1	33.0	6	4	9.5	33.0	81.9
11	13	18.3	33.0	6	4	9.5	33.0	81.4
12	11	8.1	33.0	6	4	9.5	33.0	84.9
13	11	18.3	33.0	6	4	9.5	33.0	95.9
13	14	10.7	33.0	6	4	9.5	33.0	84.3
13	15	21.9	33.0	6	4	9.5	33.0	80.2
14	13	10.7	33.0	6	4	9.5	33.0	87.4
15	13	21.9	33.0	6	4	9.5	33.0	98.4
15	16	0.3	33.0	6	4	9.5	33.0	84.7
15	17	1.1	33.0	6	4	9.5	33.0	81.8
16	15	0.3	33.0	6	4	9.5	33.0	81.2
17	15	1.1	33.0	6	4	9.5	33.0	91.2
18	19	18.4	24.6	6	4	9.5	33.0	93.3
19	18	18.4	24.6	6	4	9.5	33.0	83.7
20	21	30.0	24.6	6	4	9.5	33.0	104.7
21	20	30.0	24.6	6	4	9.5	33.0	95.1
22	23	30.0	24.2	6	4	9.5	33.0	47.4
23	22	30.0	24.2	6	4	9.5	33.0	80.9
24	25	30.4	25.1	6	4	9.5	33.0	65.1
25	24	30.4	25.1	6	4	9.5	33.0	92.5
26	27	30.4	25.1	6	4	9.5	33.0	91.1
27	26	30.4	25.1	6	4	9.5	33.0	97.9
28	29	30.4	25.1	6	4	9.5	33.0	77.1
29	28	30.4	25.1	6	4	9.5	33.0	102.0

```
 30 31     31.8  24.7         6   4     9.5   33.0          87.7
 31 30     31.8  24.7         6   4     9.5   33.0          95.7
 32 33     31.8  24.7         6   4     9.5   33.0          97.5
 33 32     31.8  24.7         6   4     9.5   33.0          82.8
 34 35     30.4  24.7         6   4     9.5   33.0          92.5
 35 34     30.4  24.7         6   4     9.5   33.0         108.6
  1  2     12.4  33.0         7   4    21.4   33.0          75.1
  2  1     12.4  33.0         7   4    21.4   33.0          73.9
  2  3      8.8  33.0         7   4    21.4   33.0          61.0
 X FOR DIST =    0.10000D+01
 X FOR DIST =    0.10000D+01
  2  4     21.7  33.0         7   4    21.4   33.0          29.1
  3  2      8.8  33.0         7   4    21.4   33.0          47.1
  3  5    -20.2  33.0         7   4    21.4   33.0          46.3
 X FOR DIST =    0.10000D+01
 X FOR DIST =    0.10000D+01
  4  2     21.7  33.0         7   4    21.4   33.0          59.1
 X FOR DIST =    0.10000D+01
 X FOR DIST =    0.10000D+01
  4  6      9.5  33.0         7   4    21.4   33.0          57.8
 X FOR DIST =    0.10000D+01
 X FOR DIST =    0.10000D+01
  4  7     21.4  33.0         7   4    21.4   33.0         -63.8
  5  3    -20.2  33.0         7   4    21.4   33.0          40.0
 X FOR DIST =    0.10000D+01
 X FOR DIST =    0.10000D+01
  6  4      9.5  33.0         7   4    21.4   33.0          30.0
  7  8      8.1  33.0         7   4    21.4   33.0          19.7
  7  9     16.9  33.0         7   4    21.4   33.0          34.5
  8  7     -6.9  33.0         7   4    21.4   33.0         -49.2
  9  7     16.9  33.0         7   4    21.4   33.0         -53.8
  9 10      5.8  33.0         7   4    21.4   33.0          74.9
  9 11      8.8  33.0         7   4    21.4   33.0          46.0
 10  9      0.8  33.0         7   4    21.4   33.0          54.5
 11  9      8.8  33.0         7   4    21.4   33.0          68.5
 11 12      8.1  33.0         7   4    21.4   33.0          65.1
 11 13     18.3  33.0         7   4    21.4   33.0          61.5
 12 11      8.1  33.0         7   4    21.4   33.0          67.1
 13 11     18.3  33.0         7   4    21.4   33.0          78.1
 13 14     10.7  33.0         7   4    21.4   33.0          69.0
 13 15     21.9  33.0         7   4    21.4   33.0          65.6
 14 13     10.7  33.0         7   4    21.4   33.0          71.5
 15 13     21.9  33.0         7   4    21.4   33.0          82.5
 15 16      0.3  33.0         7   4    21.4   33.0          69.9
 15 17      1.1  33.0         7   4    21.4   33.0          67.4
 16 15      0.3  33.0         7   4    21.4   33.0          66.6
 17 15      1.1  33.0         7   4    21.4   33.0          76.6
 18 19     18.4  24.6         7   4    21.4   33.0          78.4
 19 18     18.4  24.6         7   4    21.4   33.0          74.8
 20 21     30.0  24.6         7   4    21.4   33.0          96.1
 21 20     30.0  24.6         7   4    21.4   33.0          86.5
 22 23     30.0  24.2         7   4    21.4   33.0          50.7
 23 22     30.0  24.2         7   4    21.4   33.0          71.7
 24 25     30.4  25.1         7   4    21.4   33.0          64.7
 25 24     30.4  25.1         7   4    21.4   33.0          54.0
 26 27     30.4  25.1         7   4    21.4   33.0          69.7
 27 26     30.4  25.1         7   4    21.4   33.0          70.4
 28 29     30.4  25.1         7   4    21.4   33.0          57.5
 29 28     30.4  25.1         7   4    21.4   33.0          82.8
 30 31     31.8  24.7         7   4    21.4   33.0          76.8
 31 30     31.8  24.7         7   4    21.4   33.0          67.3
 32 33     31.8  24.7         7   4    21.4   33.0          77.6
 33 32     31.8  24.7         7   4    21.4   33.0          63.2
 34 35     30.4  24.7         7   4    21.4   33.0          73.6
 35 34     30.4  24.7         7   4    21.4   33.0          95.5
  1  2     12.4  33.0         7   8     8.1   33.0          88.[illegible]
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2	1	12.4	33.0	7	8	8.1	33.0	87.2
2	3	8.8	33.0	7	8	8.1	33.0	74.3
2	4	21.7	33.0	7	8	8.1	33.0	75.4
3	2	8.8	33.0	7	8	8.1	33.0	60.4
3	5	-20.2	33.0	7	8	8.1	33.0	59.6
4	2	21.7	33.0	7	8	8.1	33.0	72.4
4	6	9.5	33.0	7	8	8.1	33.0	86.1
4	7	21.4	33.0	7	8	8.1	33.0	-40.5
5	3	-20.2	33.0	7	8	8.1	33.0	53.3
6	4	9.5	33.0	7	8	8.1	33.0	76.3
7	4	21.4	33.0	7	8	8.1	33.0	46.3
7	9	16.9	33.0	7	8	8.1	33.0	37.8
8	7	-6.9	33.0	7	8	8.1	33.0	-25.9
9	7	16.9	33.0	7	8	8.1	33.0	-30.5
9	10	5.8	33.0	7	8	8.1	33.0	78.2
9	11	8.8	33.0	7	8	8.1	33.0	49.3
10	9	0.8	33.0	7	8	8.1	33.0	57.8
11	9	8.8	33.0	7	8	8.1	33.0	71.8
11	12	8.1	33.0	7	8	8.1	33.0	68.4
11	13	18.3	33.0	7	8	8.1	33.0	64.8
12	11	8.1	33.0	7	8	8.1	33.0	70.4
13	11	18.3	33.0	7	8	8.1	33.0	81.4
13	14	10.7	33.0	7	8	8.1	33.0	72.3
13	15	21.9	33.0	7	8	8.1	33.0	68.9
14	13	10.7	33.0	7	8	8.1	33.0	74.6
15	13	21.9	33.0	7	8	8.1	33.0	85.8
15	16	0.3	33.0	7	8	8.1	33.0	73.2
15	17	1.1	33.0	7	8	8.1	33.0	70.7
16	15	0.3	33.0	7	8	8.1	33.0	69.9
17	15	1.1	33.0	7	8	8.1	33.0	79.9
18	19	18.4	24.6	7	8	8.1	33.0	97.7
19	18	18.4	24.6	7	8	8.1	33.0	94.1
20	21	30.0	24.6	7	8	8.1	33.0	115.4
21	20	30.0	24.6	7	8	8.1	33.0	105.8
22	23	30.0	24.2	7	8	8.1	33.0	70.0
23	22	30.0	24.2	7	8	8.1	33.0	91.0
24	25	30.4	25.1	7	8	8.1	33.0	93.0
25	24	30.4	25.1	7	8	8.1	33.0	100.3
26	27	30.4	25.1	7	8	8.1	33.0	96.0
27	26	30.4	25.1	7	8	8.1	33.0	104.7
28	29	30.4	25.1	7	8	8.1	33.0	70.8
29	28	30.4	25.1	7	8	8.1	33.0	96.1
30	31	31.8	24.7	7	8	8.1	33.0	90.1
31	30	31.8	24.7	7	8	8.1	33.0	87.6
32	33	31.8	24.7	7	8	8.1	33.0	97.9
33	32	31.8	24.7	7	8	8.1	33.0	91.5
34	35	30.4	24.7	7	8	8.1	33.0	75.9
35	34	30.4	24.7	7	8	8.1	33.0	91.8
1	2	12.4	33.0	7	9	16.9	33.0	83.6
2	1	12.4	33.0	7	9	16.9	33.0	82.4
2	3	8.8	33.0	7	9	16.9	33.0	75.5
2	4	21.7	33.0	7	9	16.9	33.0	72.6
3	2	8.8	33.0	7	9	16.9	33.0	55.6
3	5	-20.2	33.0	7	9	16.9	33.0	60.8
4	2	21.7	33.0	7	9	16.9	33.0	67.6
4	6	9.5	33.0	7	9	16.9	33.0	85.3
4	7	21.4	33.0	7	9	16.9	33.0	-49.3
5	3	-20.2	33.0	7	9	16.9	33.0	54.5
6	4	9.5	33.0	7	9	16.9	33.0	73.5
7	4	21.4	33.0	7	9	16.9	33.0	43.5
7	8	8.1	33.0	7	9	16.9	33.0	20.2
8	7	-6.9	33.0	7	9	16.9	33.0	-34.7
9	7	16.9	33.0	7	9	16.9	33.0	-39.3
9	10	5.8	33.0	7	9	16.9	33.0	52.4
9	11	8.8	33.0	7	9	16.9	33.0	23.5
10	9	0.8	33.0	7	9	16.9	33.0	20.0

11	9	8.8	33.0	7	9	16.9	33.0	34.0
11	12	8.1	33.0	7	9	16.9	33.0	42.6
11	13	18.3	33.0	7	9	16.9	33.0	27.0
12	11	8.1	33.0	7	9	16.9	33.0	44.6
13	11	18.3	33.0	7	9	16.9	33.0	55.6
13	14	10.7	33.0	7	9	16.9	33.0	56.5
13	15	21.9	33.0	7	9	16.9	33.0	31.1
14	13	10.7	33.0	7	9	16.9	33.0	37.0
15	13	21.9	33.0	7	9	16.9	33.0	48.0
15	16	0.3	33.0	7	9	16.9	33.0	47.4
15	17	1.1	33.0	7	9	16.9	33.0	32.9
16	15	0.3	33.0	7	9	16.9	33.0	32.1
17	15	1.1	33.0	7	9	16.9	33.0	42.1
18	19	18.4	24.6	7	9	16.9	33.0	88.9
19	18	18.4	24.6	7	9	16.9	33.0	85.3
20	21	30.0	24.6	7	9	16.9	33.0	106.6
21	20	30.0	24.6	7	9	16.9	33.0	97.0
22	23	30.0	24.2	7	9	16.9	33.0	61.2
23	22	30.0	24.2	7	9	16.9	33.0	82.2
24	25	30.4	25.1	7	9	16.9	33.0	90.2
25	24	30.4	25.1	7	9	16.9	33.0	97.5
26	27	30.4	25.1	7	9	16.9	33.0	95.2
27	26	30.4	25.1	7	9	16.9	33.0	101.9
28	29	30.4	25.1	7	9	16.9	33.0	72.0
29	28	30.4	25.1	7	9	16.9	33.0	97.3
30	31	31.8	24.7	7	9	16.9	33.0	91.3
31	30	31.8	24.7	7	9	16.9	33.0	88.8
32	33	31.8	24.7	7	9	16.9	33.0	99.1
33	32	31.8	24.7	7	9	16.9	33.0	88.7
34	35	30.4	24.7	7	9	16.9	33.0	74.1
35	34	30.4	24.7	7	9	16.9	33.0	90.0
1	2	12.4	33.0	8	7	-6.9	33.0	107.3
2	1	12.4	33.0	8	7	-6.9	33.0	106.1
2	3	8.8	33.0	8	7	-6.9	33.0	93.3
2	4	21.7	33.0	8	7	-6.9	33.0	86.4
3	2	8.8	33.0	8	7	-6.9	33.0	86.3
3	5	-20.2	33.0	8	7	-6.9	33.0	74.5
4	2	21.7	33.0	8	7	-6.9	33.0	91.3
4	6	9.5	33.0	8	7	-6.9	33.0	97.2
4	7	21.4	33.0	8	7	-6.9	33.0	28.4
5	3	-20.2	33.0	8	7	-6.9	33.0	72.2
6	4	9.5	33.0	8	7	-6.9	33.0	87.4
7	4	21.4	33.0	8	7	-6.9	33.0	57.4
7	8	8.1	33.0	8	7	-6.9	33.0	-73.9
7	9	16.9	33.0	8	7	-6.9	33.0	62.7
9	7	16.9	33.0	8	7	-6.9	33.0	24.4
9	10	5.8	33.0	8	7	-6.9	33.0	103.1
9	11	8.8	33.0	8	7	-6.9	33.0	74.3
10	9	0.8	33.0	8	7	-6.9	33.0	82.7
11	9	8.8	33.0	8	7	-6.9	33.0	96.7
11	12	8.1	33.0	8	7	-6.9	33.0	93.3
11	13	18.3	33.0	8	7	-6.9	33.0	89.7
12	11	8.1	33.0	8	7	-6.9	33.0	95.4
13	11	18.3	33.0	8	7	-6.9	33.0	106.3
13	14	10.7	33.0	8	7	-6.9	33.0	97.3
13	15	21.9	33.0	8	7	-6.9	33.0	93.9
14	13	10.7	33.0	8	7	-6.9	33.0	99.7
15	13	21.9	33.0	8	7	-6.9	33.0	110.7
15	16	0.3	33.0	8	7	-6.9	33.0	98.2
15	17	1.1	33.0	8	7	-6.9	33.0	95.7
16	15	0.3	33.0	8	7	-6.9	33.0	94.9
17	15	1.1	33.0	8	7	-6.9	33.0	104.9
18	19	18.4	24.6	8	7	-6.9	33.0	102.7
19	18	18.4	24.6	8	7	-6.9	33.0	99.1
20	21	30.0	24.6	8	7	-6.9	33.0	120.4
[illegible]	[illegible]	30.0	24.6	8	7	-6.9	33.0	110.8

22	23	30.0	24.2	8	7	-6.9	33.0	75.0
23	22	30.0	24.2	8	7	-6.9	33.0	96.0
24	25	30.4	25.1	8	7	-6.9	33.0	104.1
25	24	30.4	25.1	8	7	-6.9	33.0	-111.3
26	27	30.4	25.1	8	7	-6.9	33.0	109.0
27	26	30.4	25.1	8	7	-6.9	33.0	-115.7
28	29	30.4	25.1	8	7	-6.9	33.0	89.7
29	28	30.4	25.1	8	7	-6.9	33.0	-115.1
30	31	31.8	24.7	8	7	-6.9	33.0	111.1
31	30	31.8	24.7	8	7	-6.9	33.0	-102.6
32	33	31.8	24.7	8	7	-6.9	33.0	112.9
33	32	31.8	24.7	8	7	-6.9	33.0	-102.6
34	35	30.4	24.7	8	7	-6.9	33.0	107.9
35	34	30.4	24.7	8	7	-6.9	33.0	-123.7
1	2	12.4	33.0	9	7	16.9	33.0	75.7
2	1	12.4	33.0	9	7	16.9	33.0	81.7
2	3	8.8	33.0	9	7	16.9	33.0	63.1
2	4	21.7	33.0	9	7	16.9	33.0	49.5
3	2	8.8	33.0	9	7	16.9	33.0	54.7
3	5	-20.2	33.0	9	7	16.9	33.0	34.3
4	2	21.7	33.0	9	7	16.9	33.0	59.7
4	6	9.5	33.0	9	7	16.9	33.0	48.4
4	7	21.4	33.0	9	7	16.9	33.0	39.0
5	3	-20.2	33.0	9	7	16.9	33.0	42.1
6	4	9.5	33.0	9	7	16.9	33.0	50.5
7	4	21.4	33.0	9	7	16.9	33.0	32.5
7	8	8.1	33.0	9	7	16.9	33.0	58.5
7	9	16.9	33.0	9	7	16.9	33.0	-59.3
8	7	-6.9	33.0	9	7	16.9	33.0	33.6
9	10	5.8	33.0	9	7	16.9	33.0	10.9
9	11	8.8	33.0	9	7	16.9	33.0	30.9
10	9	0.8	33.0	9	7	16.9	33.0	-57.3
11	9	8.8	33.0	9	7	16.9	33.0	-54.3
11	12	8.1	33.0	9	7	16.9	33.0	64.2
11	13	18.3	33.0	9	7	16.9	33.0	62.2
12	11	8.1	33.0	9	7	16.9	33.0	64.0
13	11	18.3	33.0	9	7	16.9	33.0	74.9
13	14	10.7	33.0	9	7	16.9	33.0	70.7
13	15	21.9	33.0	9	7	16.9	33.0	67.9
14	13	10.7	33.0	9	7	16.9	33.0	72.1
15	13	21.9	33.0	9	7	16.9	33.0	83.2
15	16	0.3	33.0	9	7	16.9	33.0	72.1
15	17	1.1	33.0	9	7	16.9	33.0	69.9
16	15	0.3	33.0	9	7	16.9	33.0	68.9
17	15	1.1	33.0	9	7	16.9	33.0	78.9
18	19	18.4	24.6	9	7	16.9	33.0	82.3
19	18	18.4	24.6	9	7	16.9	33.0	78.7
20	21	30.0	24.6	9	7	16.9	33.0	94.1
21	20	30.0	24.6	9	7	16.9	33.0	90.5
22	23	30.0	24.2	9	7	16.9	33.0	60.7
23	22	30.0	24.2	9	7	16.9	33.0	75.4
24	25	30.4	25.1	9	7	16.9	33.0	74.5
25	24	30.4	25.1	9	7	16.9	33.0	77.7
26	27	30.4	25.1	9	7	16.9	33.0	79.0
27	26	30.4	25.1	9	7	16.9	33.0	85.7
28	29	30.4	25.1	9	7	16.9	33.0	69.3
29	28	30.4	25.1	9	7	16.9	33.0	88.9
30	31	31.8	24.7	9	7	16.9	33.0	78.5
31	30	31.8	24.7	9	7	16.9	33.0	63.7
32	33	31.8	24.7	9	7	16.9	33.0	73.6
33	32	31.8	24.7	9	7	16.9	33.0	51.3
34	35	30.4	24.7	9	7	16.9	33.0	73.5
35	34	30.4	24.7	9	7	16.9	33.0	93.3
1	2	12.4	33.0	9	10	5.8	33.0	64.8
2	1	12.4	33.0	9	10	5.8	33.0	63.8
2	3	8.8	33.0	9	10	5.8	33.0	70.2

2	4	21.7	33.0	9	10	5.8	33.0	77.6
3	2	8.8	33.0	9	10	5.8	33.0	43.8
3	5	-20.2	33.0	9	10	5.8	33.0	45.4
4	2	21.7	33.0	9	10	5.8	33.0	48.8
4	6	9.5	33.0	9	10	5.8	33.0	81.5
4	7	21.4	33.0	9	10	5.8	33.0	72.1
5	3	-20.2	33.0	9	10	5.8	33.0	49.2
6	4	9.5	33.0	9	10	5.8	33.0	78.6
7	4	21.4	33.0	9	10	5.8	33.0	60.6
7	8	8.1	33.0	9	10	5.8	33.0	91.6
7	9	16.9	33.0	9	10	5.8	33.0	-44.2
8	7	-6.9	33.0	9	10	5.8	33.0	66.7
9	7	16.9	33.0	9	10	5.8	33.0	33.1
9	11	8.8	33.0	9	10	5.8	33.0	42.0
10	9	0.8	33.0	9	10	5.8	33.0	-42.2
11	9	8.8	33.0	9	10	5.8	33.0	-39.2
11	12	8.1	33.0	9	10	5.8	33.0	69.3
11	13	18.3	33.0	9	10	5.8	33.0	73.3
12	11	8.1	33.0	9	10	5.8	33.0	75.1
13	11	18.3	33.0	9	10	5.8	33.0	86.0
13	14	10.7	33.0	9	10	5.8	33.0	75.8
13	15	21.9	33.0	9	10	5.8	33.0	79.0
14	13	10.7	33.0	9	10	5.8	33.0	83.2
15	13	21.9	33.0	9	10	5.8	33.0	94.3
15	16	0.3	33.0	9	10	5.8	33.0	83.2
15	17	1.1	33.0	9	10	5.8	33.0	81.0
16	15	0.3	33.0	9	10	5.8	33.0	80.0
17	15	1.1	33.0	9	10	5.8	33.0	90.0
18	19	18.4	24.6	9	10	5.8	33.0	99.4
19	18	18.4	24.6	9	10	5.8	33.0	95.8
20	21	30.0	24.6	9	10	5.8	33.0	111.2
21	20	30.0	24.6	9	10	5.8	33.0	107.6
22	23	30.0	24.2	9	10	5.8	33.0	77.8
23	22	30.0	24.2	9	10	5.8	33.0	92.5
24	25	30.4	25.1	9	10	5.8	33.0	92.6
25	24	30.4	25.1	9	10	5.8	33.0	99.8
26	27	30.4	25.1	9	10	5.8	33.0	97.1
27	26	30.4	25.1	9	10	5.8	33.0	103.8
28	29	30.4	25.1	9	10	5.8	33.0	51.4
29	28	30.4	25.1	9	10	5.8	33.0	71.0
30	31	31.8	24.7	9	10	5.8	33.0	89.6
31	30	31.8	24.7	9	10	5.8	33.0	84.8
32	33	31.8	24.7	9	10	5.8	33.0	94.7
33	32	31.8	24.7	9	10	5.8	33.0	84.4
34	35	30.4	24.7	9	10	5.8	33.0	80.6
35	34	30.4	24.7	9	10	5.8	33.0	100.4
1	2	12.4	33.0	9	11	8.8	33.0	100.8
2	1	12.4	33.0	9	11	8.8	33.0	97.8
2	3	8.8	33.0	9	11	8.8	33.0	86.2
2	4	21.7	33.0	9	11	8.8	33.0	84.6
3	2	8.8	33.0	9	11	8.8	33.0	79.6
3	5	-20.2	33.0	9	11	8.8	33.0	63.4
4	2	21.7	33.0	9	11	8.8	33.0	84.8
4	6	9.5	33.0	9	11	8.8	33.0	95.5
4	7	21.4	33.0	9	11	8.8	33.0	88.1
5	3	-20.2	33.0	9	11	8.8	33.0	67.2
6	4	9.5	33.0	9	11	8.8	33.0	85.6
7	4	21.4	33.0	9	11	8.8	33.0	67.6
7	8	8.1	33.0	9	11	8.8	33.0	105.6
7	9	16.9	33.0	9	11	8.8	33.0	-4[illegible].2
8	7	-6.9	33.0	9	11	8.8	33.0	60.7
9	7	16.9	33.0	9	11	8.8	33.0	47.1
9	10	5.8	33.0	9	11	8.8	33.0	38.[illegible]
10	9	0.8	33.0	9	11	8.8	33.0	-39.[illegible]
11	9	8.8	33.0	9	11	8.8	33.0	-36.2
11	12	[illegible]	33.0	9	11	[illegible]	[illegible]	[illegible]

11	13	18.3	33.0	9	11	8.8	33.0	53.3
12	11	8.1	33.0	9	11	8.8	33.0	33.1
13	11	18.3	33.0	9	11	8.8	33.0	44.0
13	14	10.7	33.0	9	11	8.8	33.0	68.8
13	15	21.9	33.0	9	11	8.8	33.0	49.0
14	13	10.7	33.0	9	11	8.8	33.0	63.2
15	13	21.9	33.0	9	11	8.8	33.0	74.3
15	16	0.3	33.0	9	11	8.8	33.0	41.2
15	17	1.1	33.0	9	11	8.8	33.0	57.0
16	15	0.3	33.0	9	11	8.8	33.0	50.0
17	15	1.1	33.0	9	11	8.8	33.0	60.0
18	19	18.4	24.6	9	11	8.8	33.0	96.4
19	18	18.4	24.6	9	11	8.8	33.0	92.8
20	21	30.0	24.6	9	11	8.8	33.0	108.2
21	20	30.0	24.6	9	11	8.8	33.0	104.6
22	23	30.0	24.2	9	11	8.8	33.0	74.8
23	22	30.0	24.2	9	11	8.8	33.0	89.5
24	25	30.4	25.1	9	11	8.8	33.0	99.6
25	24	30.4	25.1	9	11	8.8	33.0	106.6
26	27	30.4	25.1	9	11	8.8	33.0	104.1
27	26	30.4	25.1	9	11	8.8	33.0	110.8
28	29	30.4	25.1	9	11	8.8	33.0	87.4
29	28	30.4	25.1	9	11	8.8	33.0	107.0
30	31	31.8	24.7	9	11	8.8	33.0	107.6
31	30	31.8	24.7	9	11	8.8	33.0	98.8
32	33	31.8	24.7	9	11	8.8	33.0	106.7
33	32	31.8	24.7	9	11	8.8	33.0	98.4
34	35	30.4	24.7	9	11	8.8	33.0	77.6
35	34	30.4	24.7	9	11	8.8	33.0	97.4
1	2	12.4	33.0	10	9	0.8	33.0	108.1
2	1	12.4	33.0	10	9	0.8	33.0	107.1
2	3	8.8	33.0	10	9	0.8	33.0	95.4
2	4	21.7	33.0	10	9	0.8	33.0	92.1
3	2	8.8	33.0	10	9	0.8	33.0	67.1
3	5	-20.2	33.0	10	9	0.8	33.0	70.7
4	2	21.7	33.0	10	9	0.8	33.0	92.1
4	6	9.5	33.0	10	9	0.8	33.0	103.0
4	7	21.4	33.0	10	9	0.8	33.0	92.5
5	3	-20.2	33.0	10	9	0.8	33.0	74.4
6	4	9.5	33.0	10	9	0.8	33.0	93.1
7	4	21.4	33.0	10	9	0.8	33.0	63.1
7	8	8.1	33.0	10	9	0.8	33.0	112.0
7	9	16.9	33.0	10	9	0.8	33.0	24.0
8	7	-6.9	33.0	10	9	0.8	33.0	87.1
9	7	16.9	33.0	10	9	0.8	33.0	65.5
9	10	5.8	33.0	10	9	0.8	33.0	-40.2
9	11	8.8	33.0	10	9	0.8	33.0	28.1
11	9	8.8	33.0	10	9	0.8	33.0	36.0
11	12	8.1	33.0	10	9	0.8	33.0	61.3
11	13	18.3	33.0	10	9	0.8	33.0	79.0
12	11	8.1	33.0	10	9	0.8	33.0	61.2
13	11	18.3	33.0	10	9	0.8	33.0	72.[illegible]
13	14	10.7	33.0	10	9	0.8	33.0	87.2
13	15	21.9	33.0	10	9	0.8	33.0	84.5
14	13	10.7	33.0	10	9	0.8	33.0	89.0
15	13	21.9	33.0	10	9	0.8	33.0	100.0
15	16	0.3	33.0	10	9	0.8	33.0	88.7
15	17	1.1	33.0	10	9	0.8	33.0	86.4
16	15	0.3	33.0	10	9	0.8	33.0	85.5
17	15	1.1	33.0	10	9	0.8	33.0	95.5
18	19	18.4	24.6	10	9	0.8	33.0	94.6
19	18	18.4	24.6	10	9	0.8	33.0	91.0
20	21	30.0	24.6	10	9	0.8	33.0	99.3
21	20	30.0	24.6	10	9	0.8	33.0	95.8
22	23	30.0	24.2	10	9	0.8	33.0	60.0
23	22	30.0	24.2	10	9	0.8	33.0	80.8

24	25	30.4	25.1	10	9	0.8	33.0	101.4
25	24	30.4	25.1	10	9	0.8	33.0	108.6
26	27	30.4	25.1	10	9	0.8	33.0	106.0
27	26	30.4	25.1	10	9	0.8	33.0	112.7
28	29	30.4	25.1	10	9	0.8	33.0	95.1
29	28	30.4	25.1	10	9	0.8	33.0	114.7
30	31	31.8	24.7	10	9	0.8	33.0	115.2
31	30	31.8	24.7	10	9	0.8	33.0	99.5
32	33	31.8	24.7	10	9	0.8	33.0	116.4
33	32	31.8	24.7	10	9	0.8	33.0	106.1
34	35	30.4	24.7	10	9	0.8	33.0	95.7
35	34	30.4	24.7	10	9	0.8	33.0	115.4
1	2	12.4	33.0	11	9	8.8	33.0	81.7
2	1	12.4	33.0	11	9	8.8	33.0	80.9
2	3	8.8	33.0	11	9	8.8	33.0	51.6
2	4	21.7	33.0	11	9	8.8	33.0	69.6
3	2	8.8	33.0	11	9	8.8	33.0	60.7
3	5	-20.2	33.0	11	9	8.8	33.0	26.7
4	2	21.7	33.0	11	9	8.8	33.0	65.7
4	6	9.5	33.0	11	9	8.8	33.0	76.5
4	7	21.4	33.0	11	9	8.8	33.0	63.6
5	3	-20.2	33.0	11	9	8.8	33.0	30.5
6	4	9.5	33.0	11	9	8.8	33.0	70.5
7	4	21.4	33.0	11	9	8.8	33.0	52.5
7	8	8.1	33.0	11	9	8.8	33.0	83.3
7	9	16.9	33.0	11	9	8.8	33.0	44.0
8	7	-6.9	33.0	11	9	8.8	33.0	58.3
9	7	16.9	33.0	11	9	8.8	33.0	36.7
9	10	5.8	33.0	11	9	8.8	33.0	28.1
9	11	8.8	33.0	11	9	8.8	33.0	-50.2
10	9	0.8	33.0	11	9	8.8	33.0	42.0
11	12	8.1	33.0	11	9	8.8	33.0	32.3
11	13	18.3	33.0	11	9	8.8	33.0	48.5
12	11	8.1	33.0	11	9	8.8	33.0	-40.1
13	11	18.3	33.0	11	9	8.8	33.0	-35.2
13	14	10.7	33.0	11	9	8.8	33.0	63.7
13	15	21.9	33.0	11	9	8.8	33.0	74.1
14	13	10.7	33.0	11	9	8.8	33.0	76.5
15	13	21.9	33.0	11	9	8.8	33.0	87.5
15	16	0.3	33.0	11	9	8.8	33.0	78.0
15	17	1.1	33.0	11	9	8.8	33.0	69.4
16	15	0.3	33.0	11	9	8.8	33.0	75.1
17	15	1.1	33.0	11	9	8.8	33.0	85.1
18	19	18.4	24.6	11	9	8.8	33.0	90.0
19	18	18.4	24.6	11	9	8.8	33.0	66.3
20	21	30.0	24.6	11	9	8.8	33.0	107.8
21	20	30.0	24.6	11	9	8.8	33.0	104.3
22	23	30.0	24.2	11	9	8.8	33.0	74.4
23	22	30.0	24.2	11	9	8.8	33.0	82.8
24	25	30.4	25.1	11	9	8.8	33.0	90.4
25	24	30.4	25.1	11	9	8.8	33.0	90.5
26	27	30.4	25.1	11	9	8.8	33.0	94.6
27	26	30.4	25.1	11	9	8.8	33.0	101.3
28	29	30.4	25.1	11	9	8.8	33.0	71.3
29	28	30.4	25.1	11	9	8.8	33.0	91.2
30	31	31.8	24.7	11	9	8.8	33.0	69.9
31	30	31.8	24.7	11	9	8.8	33.0	60.9
32	33	31.8	24.7	11	9	8.8	33.0	70.6
33	32	31.8	24.7	11	9	8.8	33.0	78.3
34	35	30.4	24.7	11	9	8.8	33.0	75.5
35	34	30.4	24.7	11	9	8.8	33.0	101.2
1	2	12.4	33.0	11	12	8.1	33.0	97.4
2	1	12.4	33.0	11	12	8.1	33.0	96.6
2	3	8.8	33.0	11	12	8.1	33.0	85.3
2	4	21.7	33.0	11	12	8.1	33.0	81.3
3	2	8.8	33.0	11	12	8.1	33.0	76.4

3	5	-20.2	33.0	11	12	8.1	33.0	60.4
4	2	21.7	33.0	11	12	8.1	33.0	81.4
4	6	9.5	33.0	11	12	8.1	33.0	92.2
4	7	21.4	33.0	11	12	8.1	33.0	85.3
5	3	-20.2	33.0	11	12	8.1	33.0	64.2
6	4	9.5	33.0	11	12	8.1	33.0	82.2
7	4	21.4	33.0	11	12	8.1	33.0	64.2
7	8	8.1	33.0	11	12	8.1	33.0	105.0
7	9	16.9	33.0	11	12	8.1	33.0	77.7
8	7	-6.9	33.0	11	12	8.1	33.0	80.0
9	7	16.9	33.0	11	12	8.1	33.0	58.4
9	10	5.8	33.0	11	12	8.1	33.0	61.8
9	11	8.8	33.0	11	12	8.1	33.0	-39.5
10	9	0.8	33.0	11	12	8.1	33.0	75.7
11	9	8.8	33.0	11	12	8.1	33.0	33.7
11	13	18.3	33.0	11	12	8.1	33.0	39.2
12	11	8.1	33.0	11	12	8.1	33.0	-29.4
13	11	18.3	33.0	11	12	8.1	33.0	-24.5
13	14	10.7	33.0	11	12	8.1	33.0	49.4
13	15	21.9	33.0	11	12	8.1	33.0	64.8
14	13	10.7	33.0	11	12	8.1	33.0	67.2
15	13	21.9	33.0	11	12	8.1	33.0	78.2
15	16	0.3	33.0	11	12	8.1	33.0	68.7
15	17	1.1	33.0	11	12	8.1	33.0	60.1
16	15	0.3	33.0	11	12	8.1	33.0	65.6
17	15	1.1	33.0	11	12	8.1	33.0	75.8
18	19	18.4	24.6	11	12	8.1	33.0	96.7
19	18	18.4	24.6	11	12	8.1	33.0	93.0
20	21	30.0	24.6	11	12	8.1	33.0	108.5
21	20	30.0	24.6	11	12	8.1	33.0	105.0
22	23	30.0	24.2	11	12	8.1	33.0	75.1
23	22	30.0	24.2	11	12	8.1	33.0	89.5
24	25	30.4	25.1	11	12	8.1	33.0	101.1
25	24	30.4	25.1	11	12	8.1	33.0	108.2
26	27	30.4	25.1	11	12	8.1	33.0	105.3
27	26	30.4	25.1	11	12	8.1	33.0	112.0
28	29	30.4	25.1	11	12	8.1	33.0	79.0
29	28	30.4	25.1	11	12	8.1	33.0	102.9
30	31	31.8	24.7	11	12	8.1	33.0	103.6
31	30	31.8	24.7	11	12	8.1	33.0	94.6
32	33	31.8	24.7	11	12	8.1	33.0	104.3
33	32	31.8	24.7	11	12	8.1	33.0	94.0
34	35	30.4	24.7	11	12	8.1	33.0	65.2
35	34	30.4	24.7	11	12	8.1	33.0	86.9
1	2	12.4	33.0	11	13	18.3	33.0	87.2
2	1	12.4	33.0	11	13	18.3	33.0	86.4
2	3	8.8	33.0	11	13	18.3	33.0	81.1
2	4	21.7	33.0	11	13	18.3	33.0	77.1
3	2	8.8	33.0	11	13	18.3	33.0	66.2
3	5	-20.2	33.0	11	13	18.3	33.0	56.2
4	2	21.7	33.0	11	13	18.3	33.0	71.2
4	6	9.5	33.0	11	13	18.3	33.0	88.0
4	7	21.4	33.0	11	13	18.3	33.0	81.1
5	3	-20.2	33.0	11	13	18.3	33.0	60.0
6	4	9.5	33.0	11	13	18.3	33.0	78.0
7	4	21.4	33.0	11	13	18.3	33.0	60.0
7	8	8.1	33.0	11	13	18.3	33.0	100.8
7	9	16.9	33.0	11	13	18.3	33.0	73.5
8	7	-6.9	33.0	11	13	18.3	33.0	75.8
9	7	16.9	33.0	11	13	18.3	33.0	54.2
9	10	5.8	33.0	11	13	18.3	33.0	57.6
9	11	8.8	33.0	11	13	18.3	33.0	-49.7
10	9	0.8	33.0	11	13	18.3	33.0	71.5
11	9	8.8	33.0	11	13	18.3	33.0	29.5
11	12	8.1	33.0	11	13	18.3	33.0	16.6
12	11	8.1	33.0	11	13	18.3	33.0	-34.6

13	11	18.3	33.0	11	13	18.3	33.0	−34.7
13	14	10.7	33.0	11	13	18.3	33.0	43.2
13	15	21.9	33.0	11	13	18.3	33.0	47.6
14	13	10.7	33.0	11	13	18.3	33.0	28.0
15	13	21.9	33.0	11	13	18.3	33.0	39.0
15	16	0.3	33.0	11	13	18.3	33.0	51.5
15	17	1.1	33.0	11	13	18.3	33.0	42.9
16	15	0.3	33.0	11	13	18.3	33.0	48.6
17	15	1.1	33.0	11	13	18.3	33.0	58.6
18	19	18.4	24.6	11	13	18.3	33.0	86.5
19	18	18.4	24.6	11	13	18.3	33.0	82.8
20	21	30.0	24.6	11	13	18.3	33.0	98.3
21	20	30.0	24.6	11	13	18.3	33.0	94.8
22	23	30.0	24.2	11	13	18.3	33.0	64.9
23	22	30.0	24.2	11	13	18.3	33.0	79.3
24	25	30.4	25.1	11	13	18.3	33.0	90.9
25	24	30.4	25.1	11	13	18.3	33.0	98.0
26	27	30.4	25.1	11	13	18.3	33.0	95.1
27	26	30.4	25.1	11	13	18.3	33.0	101.8
28	29	30.4	25.1	11	13	18.3	33.0	72.8
29	28	30.4	25.1	11	13	18.3	33.0	92.7
30	31	31.8	24.7	11	13	18.3	33.0	99.4
31	30	31.8	24.7	11	13	18.3	33.0	90.4
32	33	31.8	24.7	11	13	18.3	33.0	100.1
33	32	31.8	24.7	11	13	18.3	33.0	89.8
34	35	30.4	24.7	11	13	18.3	33.0	62.0
35	34	30.4	24.7	11	13	18.3	33.0	87.7
1	2	12.4	33.0	12	11	8.1	33.0	93.9
2	1	12.4	33.0	12	11	8.1	33.0	93.2
2	3	8.8	33.0	12	11	8.1	33.0	76.1
2	4	21.7	33.0	12	11	8.1	33.0	78.4
3	2	8.8	33.0	12	11	8.1	33.0	72.9
3	5	−20.2	33.0	12	11	8.1	33.0	57.3
4	2	21.7	33.0	12	11	8.1	33.0	77.9
4	6	9.5	33.0	12	11	8.1	33.0	69.3
4	7	21.4	33.0	12	11	8.1	33.0	83.3
5	3	−20.2	33.0	12	11	8.1	33.0	67.1
6	4	9.5	33.0	12	11	8.1	33.0	79.4
7	4	21.4	33.0	12	11	8.1	33.0	49.4
7	8	8.1	33.0	12	11	8.1	33.0	102.9
7	9	16.9	33.0	12	11	8.1	33.0	77.9
8	7	−6.9	33.0	12	11	8.1	33.0	77.9
9	7	16.9	33.0	12	11	8.1	33.0	56.3
9	10	0.8	33.0	12	11	8.1	33.0	82.0
9	11	8.8	33.0	12	11	8.1	33.0	62.9
10	9	0.8	33.0	12	11	8.1	33.0	69.7
11	9	8.8	33.0	12	11	8.1	33.0	62.9
11	12	8.1	33.0	12	11	8.1	33.0	−62.5
11	13	18.3	33.0	12	11	8.1	33.0	67.0
13	11	18.3	33.0	12	11	8.1	33.0	34.0
13	14	10.7	33.0	12	11	8.1	33.0	74.0
13	15	21.9	33.0	12	11	8.1	33.0	55.8
14	13	10.7	33.0	12	11	8.1	33.0	72.9
15	13	21.9	33.0	12	11	8.1	33.0	84.0
15	16	0.3	33.0	12	11	8.1	33.0	71.8
15	17	1.1	33.0	12	11	8.1	33.0	76.0
16	15	0.3	33.0	12	11	8.1	33.0	74.8
17	15	1.1	33.0	12	11	8.1	33.0	78.8
18	19	18.4	24.6	12	11	8.1	33.0	87.1
19	18	18.4	24.6	12	11	8.1	33.0	63.3
20	21	30.0	24.6	12	11	8.1	33.0	96.6
21	20	30.0	24.6	12	11	8.1	33.0	95.0
22	23	30.0	24.2	12	11	8.1	33.0	65.9
23	22	30.0	24.2	12	11	8.1	33.0	79.9
24	25	30.4	25.1	12	11	8.1	33.0	84.7
25	24	30.4	25.1	12	11	8.1	33.0	98.7

26	27	30.4	25.1	12	11	8.1	33.0	88.7
27	26	30.4	25.1	12	11	8.1	33.0	-102.4
28	29	30.4	25.1	12	11	8.1	33.0	83.2
29	28	30.4	25.1	12	11	8.1	33.0	-99.1
30	31	31.8	24.7	12	11	8.1	33.0	100.1
31	30	31.8	24.7	12	11	8.1	33.0	-84.1
32	33	31.8	24.7	12	11	8.1	33.0	100.7
33	32	31.8	24.7	12	11	8.1	33.0	-90.5
34	35	30.4	24.7	12	11	8.1	33.0	69.5
35	34	30.4	24.7	12	11	8.1	33.0	107.0
1	2	12.4	33.0	13	11	18.3	33.0	46.3
2	1	12.4	33.0	13	11	18.3	33.0	84.7
2	3	8.8	33.0	13	11	18.3	33.0	60.6
2	4	21.7	33.0	13	11	18.3	33.0	58.6
3	2	8.8	33.0	13	11	18.3	33.0	74.3
3	5	-20.2	33.0	13	11	18.3	33.0	41.8
4	2	21.7	33.0	13	11	18.3	33.0	79.3
4	6	9.5	33.0	13	11	18.3	33.0	73.6
4	7	21.4	33.0	13	11	18.3	33.0	64.5
5	3	-20.2	33.0	13	11	18.3	33.0	51.6
6	4	9.5	33.0	13	11	18.3	33.0	59.6
7	4	21.4	33.0	13	11	18.3	33.0	41.6
7	8	8.1	33.0	13	11	18.3	33.0	84.2
7	9	16.9	33.0	13	11	18.3	33.0	60.8
8	7	-6.9	33.0	13	11	18.3	33.0	59.2
9	7	16.9	33.0	13	11	18.3	33.0	25.6
9	10	5.8	33.0	13	11	18.3	33.0	64.5
9	11	8.8	33.0	13	11	18.3	33.0	34.0
10	9	0.8	33.0	13	11	18.3	33.0	58.8
11	9	8.8	33.0	13	11	18.3	33.0	38.7
11	12	8.1	33.0	13	11	18.3	33.0	51.8
11	13	18.3	33.0	13	11	18.3	33.0	-53.7
12	11	8.1	33.0	13	11	18.3	33.0	24.0
13	14	10.7	33.0	13	11	18.3	33.0	25.4
13	15	21.9	33.0	13	11	18.3	33.0	42.6
14	13	10.7	33.0	13	11	18.3	33.0	-48.7
15	13	21.9	33.0	13	11	18.3	33.0	-53.7
15	16	0.3	33.0	13	11	18.3	33.0	58.4
15	17	1.1	33.0	13	11	18.3	33.0	63.3
16	15	0.3	33.0	13	11	18.3	33.0	61.6
17	15	1.1	33.0	13	11	18.3	33.0	65.6
18	19	18.4	24.6	13	11	18.3	33.0	76.5
19	18	18.4	24.6	13	11	18.3	33.0	72.8
20	21	30.0	24.6	13	11	18.3	33.0	92.0
21	20	30.0	24.6	13	11	18.3	33.0	88.4
22	23	30.0	24.2	13	11	18.3	33.0	62.6
23	22	30.0	24.2	13	11	18.3	33.0	69.2
24	25	30.4	25.1	13	11	18.3	33.0	53.2
25	24	30.4	25.1	13	11	18.3	33.0	72.1
26	27	30.4	25.1	13	11	18.3	33.0	57.0
27	26	30.4	25.1	13	11	18.3	33.0	63.6
28	29	30.4	25.1	13	11	18.3	33.0	73.9
29	28	30.4	25.1	13	11	18.3	33.0	89.9
30	31	31.8	24.7	13	11	18.3	33.0	84.0
31	30	31.8	24.7	13	11	18.3	33.0	67.9
32	33	31.8	24.7	13	11	18.3	33.0	84.3
33	32	31.8	24.7	13	11	18.3	33.0	74.1
34	35	30.4	24.7	13	11	18.3	33.0	92.1
35	34	30.4	24.7	13	11	18.3	33.0	51.7
1	2	12.4	33.0	13	14	10.7	33.0	57.9
2	1	12.4	33.0	13	14	10.7	33.0	96.3
	3	8.8	33.0	13	14	10.7	33.0	79.2
2	4	21.7	33.0	13	14	10.7	33.0	81.2
3	2	8.8	33.0	13	14	10.7	33.0	[illegible]
3	5	-20.2	33.0	13	14	10.7	33.0	60.4
4	[illegible]	[illegible]	33.0	13	14	10.7	33.0	[illegible]

4	6	9.5	33.0	13	14	10.7	33.0	92.2
4	7	21.4	33.0	13	14	10.7	33.0	87.1
5	3	-20.2	33.0	13	14	10.7	33.0	70.2
6	4	9.5	33.0	13	14	10.7	33.0	82.2
7	4	21.4	33.0	13	14	10.7	33.0	64.2
7	8	8.1	33.0	13	14	10.7	33.0	106.8
7	9	16.9	33.0	13	14	10.7	33.0	83.4
8	7	-6.9	33.0	13	14	10.7	33.0	81.8
9	7	16.9	33.0	13	14	10.7	33.0	48.2
9	10	5.8	33.0	13	14	10.7	33.0	87.1
9	11	8.8	33.0	13	14	10.7	33.0	74.6
10	9	0.8	33.0	13	14	10.7	33.0	81.4
11	9	8.8	33.0	13	14	10.7	33.0	61.3
11	12	8.1	33.0	13	14	10.7	33.0	70.4
11	13	18.3	33.0	13	14	10.7	33.0	-36.1
12	11	8.1	33.0	13	14	10.7	33.0	64.6
13	11	18.3	33.0	13	14	10.7	33.0	40.6
13	15	21.9	33.0	13	14	10.7	33.0	50.2

X FOR DIST = 0.10000D+01
X FOR DIST = 0.10000D+01

14	13	10.7	33.0	13	14	10.7	33.0	-31.1
15	13	21.9	33.0	13	14	10.7	33.0	-36.1
15	16	0.3	33.0	13	14	10.7	33.0	72.0
15	17	1.1	33.0	13	14	10.7	33.0	60.9
16	15	0.3	33.0	13	14	10.7	33.0	69.2
17	15	1.1	33.0	13	14	10.7	33.0	73.2
18	19	18.4	24.6	13	14	10.7	33.0	94.1
19	18	18.4	24.6	13	14	10.7	33.0	90.4
20	21	30.0	24.6	13	14	10.7	33.0	105.6
21	20	30.0	24.6	13	14	10.7	33.0	102.0
22	23	30.0	24.2	13	14	10.7	33.0	76.2
23	22	30.0	24.2	13	14	10.7	33.0	86.8
24	25	30.4	25.1	13	14	10.7	33.0	93.8
25	24	30.4	25.1	13	14	10.7	33.0	100.7
26	27	30.4	25.1	13	14	10.7	33.0	103.6
27	26	30.4	25.1	13	14	10.7	33.0	104.2
28	29	30.4	25.1	13	14	10.7	33.0	81.5
29	28	30.4	25.1	13	14	10.7	33.0	97.5
30	31	31.8	24.7	13	14	10.7	33.0	102.6
31	30	31.8	24.7	13	14	10.7	33.0	86.5
32	33	31.8	24.7	13	14	10.7	33.0	102.9
33	32	31.8	24.7	13	14	10.7	33.0	92.7
34	35	30.4	24.7	13	14	10.7	33.0	84.7
35	34	30.4	24.7	13	14	10.7	33.0	44.3
1	2	12.4	33.0	13	15	21.9	33.0	52.7
2	1	12.4	33.0	13	15	21.9	33.0	91.1
2	3	8.8	33.0	13	15	21.9	33.0	74.0
2	4	21.7	33.0	13	15	21.9	33.0	76.0
3	2	8.8	33.0	13	15	21.9	33.0	80.7
3	5	-20.2	33.0	13	15	21.9	33.0	55.2
4	2	21.7	33.0	13	15	21.9	33.0	85.7
4	6	9.5	33.0	13	15	21.9	33.0	87.0
4	7	21.4	33.0	13	15	21.9	33.0	81.9
5	3	-20.2	33.0	13	15	21.9	33.0	65.0
6	4	9.5	33.0	13	15	21.9	33.0	77.0
7	4	21.4	33.0	13	15	21.9	33.0	59.0
7	8	8.1	33.0	13	15	21.9	33.0	101.6
7	9	16.9	33.0	13	15	21.9	33.0	78.2
8	7	-6.9	33.0	13	15	21.9	33.0	76.6
9	7	16.9	33.0	13	15	21.9	33.0	43.0
9	10	5.8	33.0	13	15	21.9	33.0	[illegible]
9	11	8.8	33.0	13	15	21.9	33.0	[illegible]
10	9	0.8	33.0	13	15	21.9	33.0	76.2
11	9	8.8	33.0	13	15	21.9	33.0	[illegible]
11	12	8.1	33.0	13	15	21.9	33.0	[illegible]
[illegible]	[illegible]	[illegible]	33.0	13	15	21.9	33.0	[illegible]

12	11	8.1	33.0	13	15	21.9	33.0	59.4
13	11	18.3	33.0	13	15	21.9	33.0	35.4
13	14	10.7	33.0	13	15	21.9	33.0	27.6
14	13	10.7	33.0	13	15	21.9	33.0	-52.3
15	13	21.9	33.0	13	15	21.9	33.0	-57.3
15	16	0.3	33.0	13	15	21.9	33.0	39.8
15	17	1.1	33.0	13	15	21.9	33.0	59.7
16	15	0.3	33.0	13	15	21.9	33.0	19.0
17	15	1.1	33.0	13	15	21.9	33.0	23.0
18	19	18.4	24.6	13	15	21.9	33.0	72.9
19	18	18.4	24.6	13	15	21.9	33.0	69.2
20	21	30.0	24.6	13	15	21.9	33.0	84.4
21	20	30.0	24.6	13	15	21.9	33.0	80.8
22	23	30.0	24.2	13	15	21.9	33.0	55.0
23	22	30.0	24.2	13	15	21.9	33.0	65.6
24	25	30.4	25.1	13	15	21.9	33.0	86.6
25	24	30.4	25.1	13	15	21.9	33.0	95.5
26	27	30.4	25.1	13	15	21.9	33.0	92.4
27	26	30.4	25.1	13	15	21.9	33.0	99.0
28	29	30.4	25.1	13	15	21.9	33.0	80.3
29	28	30.4	25.1	13	15	21.9	33.0	96.3
30	31	31.8	24.7	13	15	21.9	33.0	97.4
31	30	31.8	24.7	13	15	21.9	33.0	81.3
32	33	31.8	24.7	13	15	21.9	33.0	97.7
33	32	31.8	24.7	13	15	21.9	33.0	87.5
34	35	30.4	24.7	13	15	21.9	33.0	94.5
35	34	30.4	24.7	13	15	21.9	33.0	54.1
1	2	12.4	33.0	14	13	10.7	33.0	66.4
2	1	12.4	33.0	14	13	10.7	33.0	92.9
2	3	8.8	33.0	14	13	10.7	33.0	76.1
2	4	21.7	33.0	14	13	10.7	33.0	78.3
3	2	8.8	33.0	14	13	10.7	33.0	82.5
3	5	-20.2	33.0	14	13	10.7	33.0	57.2
4	2	21.7	33.0	14	13	10.7	33.0	87.5
4	6	9.5	33.0	14	13	10.7	33.0	89.1
4	7	21.4	33.0	14	13	10.7	33.0	84.7
5	3	-20.2	33.0	14	13	10.7	33.0	67.0
6	4	9.5	33.0	14	13	10.7	33.0	79.2
7	4	21.4	33.0	14	13	10.7	33.0	49.2
7	8	6.1	33.0	14	13	10.7	33.0	104.3
7	9	16.9	33.0	14	13	10.7	33.0	81.9
8	7	-6.9	33.0	14	13	10.7	33.0	79.4
9	7	16.9	33.0	14	13	10.7	33.0	67.7
9	10	5.8	33.0	14	13	10.7	33.0	85.3
9	11	8.8	33.0	14	13	10.7	33.0	61.8
10	9	0.8	33.0	14	13	10.7	33.0	73.9
11	9	8.8	33.0	14	13	10.7	33.0	66.9
11	12	8.1	33.0	14	13	10.7	33.0	71.5
11	13	18.3	33.0	14	13	10.7	33.0	38.0
12	11	8.1	33.0	14	13	10.7	33.0	46.8
13	11	18.3	33.0	14	13	10.7	33.0	55.8

X FOR DIST = 0.10000D+01
X FOR DIST = 0.10000D+01

13	14	10.7	33.0	14	13	10.7	33.0	67.8
13	15	21.9	33.0	14	13	10.7	33.0	62.4
15	13	21.9	33.0	14	13	10.7	33.0	44.0
15	16	0.3	33.0	14	13	10.7	33.0	59.3
15	17	1.1	33.0	14	13	10.7	33.0	60.3
16	15	0.3	33.0	14	13	10.7	33.0	59.4
17	15	1.1	33.0	14	13	10.7	33.0	63.4
18	19	18.4	24.6	14	13	10.7	33.0	84.9
19	18	18.4	24.6	14	13	10.7	33.0	81.1
20	21	30.0	24.6	14	13	10.7	33.0	95.9
21	20	30.0	24.6	14	13	10.7	33.0	92.3
22	23	30.0	24.2	14	13	10.7	33.0	66.5
23	22	30.0	24.2	14	13	10.7	33.0	77.7

24	25	30.4	25.1	14	13	10.7	33.0	90.4
25	24	30.4	25.1	14	13	10.7	33.0	97.3
26	27	30.4	25.1	14	13	10.7	33.0	94.1
27	26	30.4	25.1	14	13	10.7	33.0	100.7
28	29	30.4	25.1	14	13	10.7	33.0	81.6
29	28	30.4	25.1	14	13	10.7	33.0	97.7
30	31	31.8	24.7	14	13	10.7	33.0	99.1
31	30	31.8	24.7	14	13	10.7	33.0	83.0
32	33	31.8	24.7	14	13	10.7	33.0	99.3
33	32	31.8	24.7	14	13	10.7	33.0	89.2
34	35	30.4	24.7	14	13	10.7	33.0	65.6
35	34	30.4	24.7	14	13	10.7	33.0	102.9
1	2	12.4	33.0	15	13	21.9	33.0	28.7
2	1	12.4	33.0	15	13	21.9	33.0	55.2
2	3	8.8	33.0	15	13	21.9	33.0	50.2
2	4	21.7	33.0	15	13	21.9	33.0	61.8
3	2	8.8	33.0	15	13	21.9	33.0	44.7
3	5	-20.2	33.0	15	13	21.9	33.0	31.3
4	2	21.7	33.0	15	13	21.9	33.0	49.7
4	6	9.5	33.0	15	13	21.9	33.0	68.8
4	7	21.4	33.0	15	13	21.9	33.0	65.1
5	3	-20.2	33.0	15	13	21.9	33.0	41.1
6	4	9.5	33.0	15	13	21.9	33.0	62.7
7	4	21.4	33.0	15	13	21.9	33.0	50.7
7	8	8.1	33.0	15	13	21.9	33.0	84.7
7	9	16.9	33.0	15	13	21.9	33.0	62.9
8	7	-6.9	33.0	15	13	21.9	33.0	59.7
9	7	16.9	33.0	15	13	21.9	33.0	26.1
9	10	5.8	33.0	15	13	21.9	33.0	66.3
9	11	8.8	33.0	15	13	21.9	33.0	56.0
10	9	0.8	33.0	15	13	21.9	33.0	60.9
11	9	8.8	33.0	15	13	21.9	33.0	30.9
11	12	8.1	33.0	15	13	21.9	33.0	37.0
11	13	18.3	33.0	15	13	21.9	33.0	39.0
12	11	8.1	33.0	15	13	21.9	33.0	46.0
13	11	18.3	33.0	15	13	21.9	33.0	44.0
13	14	10.7	33.0	15	13	21.9	33.0	46.1
13	15	21.9	33.0	15	13	21.9	33.0	-61.2
14	13	10.7	33.0	15	13	21.9	33.0	34.0
15	16	0.3	33.0	15	13	21.9	33.0	7.4
15	17	1.1	33.0	15	13	21.9	33.0	12.2
16	15	0.3	33.0	15	13	21.9	33.0	-71.2
17	15	1.1	33.0	15	13	21.9	33.0	-61.2
18	19	18.4	24.6	15	13	21.9	33.0	72.1
19	18	18.4	24.6	15	13	21.9	33.0	72.2
20	21	30.0	24.6	15	13	21.9	33.0	87.4
21	20	30.0	24.6	15	13	21.9	33.0	89.8
22	23	30.0	24.2	15	13	21.9	33.0	58.0
23	22	30.0	24.2	15	13	21.9	33.0	68.4
24	25	30.4	25.1	15	13	21.9	33.0	73.0
25	24	30.4	25.1	15	13	21.9	33.0	79.9
26	27	30.4	25.1	15	13	21.9	33.0	83.4
27	26	30.4	25.1	15	13	21.9	33.0	90.0
28	29	30.4	25.1	15	13	21.9	33.0	55.2
29	28	30.4	25.1	15	13	21.9	33.0	59.4
30	31	31.8	24.7	15	13	21.9	33.0	72.6
31	30	31.8	24.7	15	13	21.9	33.0	56.3
32	33	31.8	24.7	15	13	21.9	33.0	72.4
33	32	31.8	24.7	15	13	21.9	33.0	76.2
34	35	30.4	24.7	15	13	21.9	33.0	67.8
35	34	30.4	24.7	15	13	21.9	33.0	83.5
1	2	12.4	33.0	15	16	0.3	33.0	79.3
2	1	12.4	33.0	15	16	0.3	33.0	105.8
2	3	8.8	33.0	15	16	0.3	33.0	88.8
2	4	21.7	33.0	15	16	0.3	33.0	90.4
3	2	8.8	33.0	15	16	0.3	33.0	95.3

3	5	-20.2	33.0	15	16	0.3	33.0	69.9
4	2	21.7	33.0	15	16	0.3	33.0	100.3
4	6	9.5	33.0	15	16	0.3	33.0	101.4
4	7	21.4	33.0	15	16	0.3	33.0	97.7
5	3	-20.2	33.0	15	16	0.3	33.0	79.7
6	4	9.5	33.0	15	16	0.3	33.0	91.3
7	4	21.4	33.0	15	16	0.3	33.0	79.3
7	8	8.1	33.0	15	16	0.3	33.0	117.3
7	9	16.9	33.0	15	16	0.3	33.0	95.5
8	7	-6.9	33.0	15	16	0.3	33.0	92.3
9	7	16.9	33.0	15	16	0.3	33.0	58.7
9	10	5.8	33.0	15	16	0.3	33.0	98.9
9	11	8.8	33.0	15	16	0.3	33.0	88.6
10	9	0.8	33.0	15	16	0.3	33.0	93.5
11	9	8.8	33.0	15	16	0.3	33.0	63.5
11	12	8.1	33.0	15	16	0.3	33.0	87.6
11	13	18.3	33.0	15	16	0.3	33.0	89.6
12	11	8.1	33.0	15	16	0.3	33.0	78.6
13	11	18.3	33.0	15	16	0.3	33.0	76.6
13	14	10.7	33.0	15	16	0.3	33.0	74.7
13	15	21.9	33.0	15	16	0.3	33.0	-39.6
14	13	10.7	33.0	15	16	0.3	33.0	84.6
15	13	21.9	33.0	15	16	0.3	33.0	50.6
15	17	1.1	33.0	15	16	0.3	33.0	39.8
16	15	0.3	33.0	15	16	0.3	33.0	-49.6
17	15	1.1	33.0	15	16	0.3	33.0	-39.6
18	19	18.4	24.6	15	16	0.3	33.0	89.7
19	18	18.4	24.6	15	16	0.3	33.0	89.8
20	21	30.0	24.6	15	16	0.3	33.0	105.0
21	20	30.0	24.6	15	16	0.3	33.0	101.4
22	23	30.0	24.2	15	16	0.3	33.0	75.6
23	22	30.0	24.2	15	16	0.3	33.0	86.0
24	25	30.4	25.1	15	16	0.3	33.0	94.6
25	24	30.4	25.1	15	16	0.3	33.0	101.5
26	27	30.4	25.1	15	16	0.3	33.0	98.0
27	26	30.4	25.1	15	16	0.3	33.0	104.6
28	29	30.4	25.1	15	16	0.3	33.0	93.8
29	28	30.4	25.1	15	16	0.3	33.0	110.0
30	31	31.8	24.7	15	16	0.3	33.0	111.2
31	30	31.8	24.7	15	16	0.3	33.0	94.9
32	33	31.8	24.7	15	16	0.3	33.0	111.0
33	32	31.8	24.7	15	16	0.3	33.0	104.8
34	35	30.4	24.7	15	16	0.3	33.0	93.4
35	34	30.4	24.7	15	16	0.3	33.0	109.1
1	2	12.4	33.0	15	17	1.1	33.0	82.5
2	1	12.4	33.0	15	17	1.1	33.0	109.0
2	3	8.8	33.0	15	17	1.1	33.0	98.0
2	4	21.7	33.0	15	17	1.1	33.0	99.6
3	2	8.8	33.0	15	17	1.1	33.0	98.5
3	5	-20.2	33.0	15	17	1.1	33.0	79.1
4	2	21.7	33.0	15	17	1.1	33.0	103.5
4	6	9.5	33.0	15	17	1.1	33.0	110.6
4	7	21.4	33.0	15	17	1.1	33.0	106.9
5	3	-20.2	33.0	15	17	1.1	33.0	88.9
6	4	9.5	33.0	15	17	1.1	33.0	100.5
7	4	21.4	33.0	15	17	1.1	33.0	88.5
7	8	8.1	33.0	15	17	1.1	33.0	126.5
7	9	16.9	33.0	15	17	1.1	33.0	104.7
8	7	-6.9	33.0	15	17	1.1	33.0	101.5
9	7	16.9	33.0	15	17	1.1	33.0	67.9
9	10	5.8	33.0	15	17	1.1	33.0	108.1
9	11	8.8	33.0	15	17	1.1	33.0	97.8
10	9	0.8	33.0	15	17	1.1	33.0	102.7
11	9	8.8	33.0	15	17	1.1	33.0	72.7
11	12	8.1	33.0	15	17	1.1	33.0	90.8
11	13	18.3	33.0	15	17	1.1	33.0	92.8

12	11	8.1	33.0	15	17	1.1	33.0	87.8
13	11	18.3	33.0	15	17	1.1	33.0	85.8
13	14	10.7	33.0	15	17	1.1	33.0	77.9
13	15	21.9	33.0	15	17	1.1	33.0	-30.4
14	13	10.7	33.0	15	17	1.1	33.0	87.8
15	13	21.9	33.0	15	17	1.1	33.0	53.8
15	16	0.3	33.0	15	17	1.1	33.0	38.2
16	15	0.3	33.0	15	17	1.1	33.0	-40.4
17	15	1.1	33.0	15	17	1.1	33.0	-30.4
18	19	18.4	24.6	15	17	1.1	33.0	98.9
19	18	18.4	24.6	15	17	1.1	33.0	99.0
20	21	30.0	24.6	15	17	1.1	33.0	114.2
21	20	30.0	24.6	15	17	1.1	33.0	110.6
22	23	30.0	24.2	15	17	1.1	33.0	84.8
23	22	30.0	24.2	15	17	1.1	33.0	95.2
24	25	30.4	25.1	15	17	1.1	33.0	110.8
25	24	30.4	25.1	15	17	1.1	33.0	117.7
26	27	30.4	25.1	15	17	1.1	33.0	114.2
27	26	30.4	25.1	15	17	1.1	33.0	120.8
28	29	30.4	25.1	15	17	1.1	33.0	97.0
29	28	30.4	25.1	15	17	1.1	33.0	113.2
30	31	31.8	24.7	15	17	1.1	33.0	114.4
31	30	31.8	24.7	15	17	1.1	33.0	104.1
32	33	31.8	24.7	15	17	1.1	33.0	120.2
33	32	31.8	24.7	15	17	1.1	33.0	114.0
34	35	30.4	24.7	15	17	1.1	33.0	88.6
35	34	30.4	24.7	15	17	1.1	33.0	104.3
1	2	12.4	33.0	16	15	0.3	33.0	109.9
2	1	12.4	33.0	16	15	0.3	33.0	109.4
2	3	8.8	33.0	16	15	0.3	33.0	92.3
2	4	21.7	33.0	16	15	0.3	33.0	99.8
3	2	8.8	33.0	16	15	0.3	33.0	88.9
3	5	-20.2	33.0	16	15	0.3	33.0	73.4
4	2	21.7	33.0	16	15	0.3	33.0	93.9
4	6	9.5	33.0	16	15	0.3	33.0	104.8
4	7	21.4	33.0	16	15	0.3	33.0	101.0
5	3	-20.2	33.0	16	15	0.3	33.0	63.2
6	4	9.5	33.0	16	15	0.3	33.0	100.8
7	4	21.4	33.0	16	15	0.3	33.0	92.8
7	8	8.1	33.0	16	15	0.3	33.0	120.6
7	9	16.9	33.0	16	15	0.3	33.0	98.6
8	7	-6.9	33.0	16	15	0.3	33.0	95.6
9	7	16.9	33.0	16	15	0.3	33.0	74.0
9	10	5.8	33.0	16	15	0.3	33.0	102.1
9	11	8.6	33.0	16	15	0.3	33.0	91.4
10	9	0.8	33.0	16	15	0.3	33.0	96.6
11	9	8.6	33.0	16	15	0.3	33.0	54.6
11	12	8.1	33.0	16	15	0.3	33.0	84.6
11	13	18.3	33.0	16	15	0.3	33.0	86.3
12	11	8.1	33.0	16	15	0.3	33.0	81.5
13	11	18.3	33.0	16	15	0.3	33.0	79.5
13	14	10.7	33.0	16	15	0.3	33.0	74.6
13	15	21.9	33.0	16	15	0.3	33.0	59.0
14	13	10.7	33.0	16	15	0.3	33.0	67.3
15	13	21.9	33.0	16	15	0.3	33.0	71.3
15	16	0.3	33.0	16	15	0.3	33.0	-32.6
15	17	1.1	33.0	16	15	0.3	33.0	6.4
17	15	1.1	33.0	16	15	0.3	33.0	59.0
18	19	18.4	24.6	16	15	0.3	33.0	99.3
19	18	18.4	24.6	16	15	0.3	33.0	99.2
20	21	30.0	24.6	16	15	0.3	33.0	114.5
21	20	30.0	24.6	16	15	0.3	33.0	111.4
22	23	30.0	24.2	16	15	0.3	33.0	85.6
23	22	30.0	24.2	16	15	0.3	33.0	95.6
24	25	30.4	25.1	16	15	0.3	33.0	117.2
[illegible]	[illegible]	[illegible]	[illegible]	16	15	[illegible]	[illegible]	[illegible]

26	27	30.4	25.1	16	15	0.3	33.0	120.7
27	26	30.4	25.1	16	15	0.3	33.0	121.3
28	29	30.4	25.1	16	15	0.3	33.0	97.6
29	28	30.4	25.1	16	15	0.3	33.0	113.7
30	31	31.8	24.7	16	15	0.3	33.0	114.9
31	30	31.8	24.7	16	15	0.3	33.0	105.6
32	33	31.8	24.7	16	15	0.3	33.0	114.7
33	32	31.8	24.7	16	15	0.3	33.0	114.4
34	35	30.4	24.7	16	15	0.3	33.0	85.7
35	34	30.4	24.7	16	15	0.3	33.0	105.4
1	2	12.4	33.0	17	15	1.1	33.0	67.0
2	1	12.4	33.0	17	15	1.1	33.0	105.6
2	3	8.8	33.0	17	15	1.1	33.0	86.6
2	4	21.7	33.0	17	15	1.1	33.0	83.2
3	2	8.8	33.0	17	15	1.1	33.0	95.0
3	5	-20.2	33.0	17	15	1.1	33.0	69.7
4	2	21.7	33.0	17	15	1.1	33.0	100.0
4	6	9.5	33.0	17	15	1.1	33.0	101.2
4	7	21.4	33.0	17	15	1.1	33.0	97.7
5	3	-20.2	33.0	17	15	1.1	33.0	79.5
6	4	9.5	33.0	17	15	1.1	33.0	84.2
7	4	21.4	33.0	17	15	1.1	33.0	72.2
7	8	8.1	33.0	17	15	1.1	33.0	117.3
7	9	16.9	33.0	17	15	1.1	33.0	95.7
8	7	-6.9	33.0	17	15	1.1	33.0	92.3
9	7	16.9	33.0	17	15	1.1	33.0	58.7
9	10	0.8	33.0	17	15	1.1	33.0	99.1
9	11	8.8	33.0	17	15	1.1	33.0	82.0
10	9	0.8	33.0	17	15	1.1	33.0	93.7
11	9	8.8	33.0	17	15	1.1	33.0	69.7
11	12	8.1	33.0	17	15	1.1	33.0	88.0
11	13	18.3	33.0	17	15	1.1	33.0	90.5
12	11	8.1	33.0	17	15	1.1	33.0	72.1
13	11	18.3	33.0	17	15	1.1	33.0	70.1
13	14	10.7	33.0	17	15	1.1	33.0	74.8
13	15	21.9	33.0	17	15	1.1	33.0	43.0
14	13	10.7	33.0	17	15	1.1	33.0	75.5
15	13	21.9	33.0	17	15	1.1	33.0	90.5
15	16	0.3	33.0	17	15	1.1	33.0	5.6
15	17	1.1	33.0	17	15	1.1	33.0	-46.7
16	15	0.3	33.0	17	15	1.1	33.0	[illegible]
18	19	18.4	24.6	17	15	1.1	33.0	89.3
19	18	18.4	24.6	17	15	1.1	33.0	89.4
20	21	30.0	24.6	17	15	1.1	33.0	104.2
21	20	30.0	24.6	17	15	1.1	33.0	100.6
22	23	30.0	24.2	17	15	1.1	33.0	74.8
23	22	30.0	24.2	17	15	1.1	33.0	85.7
24	25	30.4	25.1	17	15	1.1	33.0	94.2
25	24	30.4	25.1	17	15	1.1	33.0	101.0
26	27	30.4	25.1	17	15	1.1	33.0	93.5
27	26	30.4	25.1	17	15	1.1	33.0	100.1
28	29	30.4	25.1	17	15	1.1	33.0	93.3
29	28	30.4	25.1	17	15	1.1	33.0	109.6
30	31	31.8	24.7	17	15	1.1	33.0	110.9
31	30	31.8	24.7	17	15	1.1	33.0	94.6
32	33	31.8	24.7	17	15	1.1	33.0	110.5
33	32	31.8	24.7	17	15	1.1	33.0	93.3
34	35	30.4	24.7	17	15	1.1	33.0	92.3
35	34	30.4	24.7	17	15	1.1	33.0	107.9
1	2	12.4	33.0	18	19	18.4	24.6	101.0
2	1	12.4	33.0	18	19	18.4	24.6	94.8
2	3	8.8	33.0	18	19	18.4	24.6	87.4
2	4	21.7	33.0	18	19	18.4	24.6	94.0
3	2	8.8	33.0	18	19	18.4	24.6	73.0
3	5	-20.2	33.0	18	19	18.4	24.6	74.5
4	2	21.7	33.0	18	19	18.4	24.6	[illegible]

4	6	9.5	33.0	18	19	18.4	24.6	85.2
4	7	21.4	33.0	18	19	18.4	24.6	87.2
5	3	-20.2	33.0	18	19	18.4	24.6	64.3
6	4	9.5	33.0	18	19	18.4	24.6	94.9
7	4	21.4	33.0	18	19	18.4	24.6	93.9
7	8	8.1	33.0	18	19	18.4	24.6	102.9
7	9	16.9	33.0	18	19	18.4	24.6	86.6
8	7	-6.9	33.0	18	19	18.4	24.6	97.8
9	7	16.9	33.0	18	19	18.4	24.6	93.2
9	10	5.8	33.0	18	19	18.4	24.6	85.8
9	11	8.8	33.0	18	19	18.4	24.6	81.1
10	9	0.8	33.0	18	19	18.4	24.6	90.6
11	9	8.8	33.0	18	19	18.4	24.6	87.6
11	12	8.1	33.0	18	19	18.4	24.6	77.5
11	13	18.3	33.0	18	19	18.4	24.6	82.1
12	11	8.1	33.0	18	19	18.4	24.6	87.2
13	11	18.3	33.0	18	19	18.4	24.6	92.1
13	14	10.7	33.0	18	19	18.4	24.6	77.8
13	15	21.9	33.0	18	19	18.4	24.6	85.2
14	13	10.7	33.0	18	19	18.4	24.6	87.1
15	13	21.9	33.0	18	19	18.4	24.6	82.1
15	16	0.3	33.0	18	19	18.4	24.6	80.9
15	17	1.1	33.0	18	19	18.4	24.6	71.5
16	15	0.3	33.0	18	19	18.4	24.6	71.2
17	15	1.1	33.0	18	19	18.4	24.6	81.2

X FOR DIST = 0.10000D+01
X FOR DIST = 0.10000D+01

19	18	18.4	24.6	18	19	18.4	24.6	-46.5
20	21	30.0	24.6	18	19	18.4	24.6	106.2
21	20	30.0	24.6	18	19	18.4	24.6	90.5
22	23	30.0	24.2	18	19	18.4	24.6	66.8
23	22	30.0	24.2	18	19	18.4	24.6	56.1
24	25	30.4	25.1	18	19	18.4	24.6	87.6
25	24	30.4	25.1	18	19	18.4	24.6	53.6
26	27	30.4	25.1	18	19	18.4	24.6	72.1
27	26	30.4	25.1	18	19	18.4	24.6	72.9
28	29	30.4	25.1	18	19	18.4	24.6	65.3
29	28	30.4	25.1	18	19	18.4	24.6	103.7
30	31	31.6	24.7	18	19	18.4	24.6	98.6
31	30	31.6	24.7	18	19	18.4	24.6	104.8
32	33	31.6	24.7	18	19	18.4	24.6	86.3
33	32	31.8	24.7	18	19	18.4	24.6	95.8
34	35	30.4	24.7	18	19	18.4	24.6	85.2
35	34	30.4	24.7	18	19	18.4	24.6	101.5
1	2	12.4	33.0	19	18	18.4	24.6	104.6
2	1	12.4	33.0	19	18	18.4	24.6	98.5
2	3	8.8	33.0	19	18	18.4	24.6	93.1
2	4	21.7	33.0	19	18	18.4	24.6	103.6
3	2	8.8	33.0	19	18	18.4	24.6	76.7
3	5	-20.2	33.0	19	18	18.4	24.6	78.0
4	2	21.7	33.0	19	18	18.4	24.6	88.7
4	6	9.5	33.0	19	18	18.4	24.6	94.8
4	7	21.4	33.0	19	18	18.4	24.6	90.8
5	3	-20.2	33.0	19	18	18.4	24.6	68.0
6	4	9.5	33.0	19	18	18.4	24.6	104.5
7	4	21.4	33.0	19	18	18.4	24.6	103.5
7	8	8.1	33.0	19	18	18.4	24.6	106.5
7	9	16.9	33.0	19	18	18.4	24.6	90.3
8	7	-6.9	33.0	19	18	18.4	24.6	101.5
9	7	16.9	33.0	19	18	18.4	24.6	96.8
9	10	5.8	33.0	19	18	18.4	24.6	89.5
9	11	8.8	33.0	19	18	18.4	24.6	84.8
10	9	0.8	33.0	19	18	18.4	24.6	94.3
11	9	6.8	33.0	19	18	18.4	24.6	91.3
11	12	8.1	33.0	19	18	18.4	24.6	81.3
11	13	18.3	33.0	19	18	18.4	24.6	85.9

12	11	8.1	33.0	19	18	18.4	24.6	90.8
13	11	18.3	33.0	19	18	18.4	24.6	95.8
13	14	10.7	33.0	19	18	18.4	24.6	81.7
13	15	21.9	33.0	19	18	18.4	24.6	85.1
14	13	10.7	33.0	19	18	18.4	24.6	90.9
15	13	21.9	33.0	19	18	18.4	24.6	85.9
15	16	0.3	33.0	19	18	18.4	24.6	80.7
15	17	1.1	33.0	19	18	18.4	24.6	71.5
16	15	0.3	33.0	19	18	18.4	24.6	71.1
17	15	1.1	33.0	19	18	18.4	24.6	81.1

X FOR DIST = 0.10000D+01
X FOR DIST = 0.10000D+01

18	19	18.4	24.6	19	18	18.4	24.6	90.0
20	21	30.0	24.6	19	18	18.4	24.6	106.9
21	20	30.0	24.6	19	18	18.4	24.6	90.9
22	23	30.0	24.2	19	18	18.4	24.6	67.5
23	22	30.0	24.2	19	18	18.4	24.6	55.7
24	25	30.4	25.1	19	18	18.4	24.6	108.2
25	24	30.4	25.1	19	18	18.4	24.6	70.2
26	27	30.4	25.1	19	18	18.4	24.6	110.8
27	26	30.4	25.1	19	18	18.4	24.6	111.5
28	29	30.4	25.1	19	18	18.4	24.6	81.0
29	28	30.4	25.1	19	18	18.4	24.6	107.4
30	31	31.8	24.7	19	18	18.4	24.6	108.3
31	30	31.8	24.7	19	18	18.4	24.6	114.5
32	33	31.8	24.7	19	18	18.4	24.6	103.0
33	32	31.8	24.7	19	18	18.4	24.6	112.5
34	35	30.4	24.7	19	18	18.4	24.6	85.2
35	34	30.4	24.7	19	18	18.4	24.6	101.5
1	2	12.4	33.0	20	21	30.0	24.6	93.6
2	1	12.4	33.0	20	21	30.0	24.6	93.4
2	3	8.8	33.0	20	21	30.0	24.6	82.3
2	4	21.7	33.0	20	21	30.0	24.6	87.1
3	2	8.8	33.0	20	21	30.0	24.6	72.6
3	5	-20.2	33.0	20	21	30.0	24.6	67.2
4	2	21.7	33.0	20	21	30.0	24.6	77.6
4	6	9.5	33.0	20	21	30.0	24.6	78.2
4	7	21.4	33.0	20	21	30.0	24.6	80.5
5	3	-20.2	33.0	20	21	30.0	24.6	57.2
6	4	9.5	33.0	20	21	30.0	24.6	88.1
7	4	21.4	33.0	20	21	30.0	24.6	87.1
7	8	8.1	33.0	20	21	30.0	24.6	96.1
7	9	16.9	33.0	20	21	30.0	24.6	80.0
8	7	-6.9	33.0	20	21	30.0	24.6	91.1
9	7	16.9	33.0	20	21	30.0	24.6	86.5
9	10	5.8	33.0	20	21	30.0	24.6	72.2
9	11	8.8	33.0	20	21	30.0	24.6	80.6
10	9	0.8	33.0	20	21	30.0	24.6	84.0
11	9	8.8	33.0	20	21	30.0	24.6	81.0
11	12	8.1	33.0	20	21	30.0	24.6	70.7
11	13	18.3	33.0	20	21	30.0	24.6	79.3
12	11	8.1	33.0	20	21	30.0	24.6	80.7
13	11	18.3	33.0	20	21	30.0	24.6	85.6
13	14	10.7	33.0	20	21	30.0	24.6	70.5
13	15	21.9	33.0	20	21	30.0	24.6	84.3
14	13	10.7	33.0	20	21	30.0	24.6	80.3
15	13	21.9	33.0	20	21	30.0	24.6	75.3
15	16	0.3	33.0	20	21	30.0	24.6	74.3
15	17	1.1	33.0	20	21	30.0	24.6	64.3
16	15	0.3	33.0	20	21	30.0	24.6	64.3
17	15	1.1	33.0	20	21	30.0	24.6	74.3
18	19	18.4	24.6	20	21	30.0	24.6	72.5
19	18	18.4	24.6	20	21	30.0	24.6	71.8

X FOR DIST = 0.10000D+01
X FOR DIST = 0.10000D+01

21	20	30.0	24.6	20	21	30.0	24.6	78.7

22	23	30.0	24.2	20	21	30.0	24.6	20.6
23	22	30.0	24.2	20	21	30.0	24.6	22.5
24	25	30.4	25.1	20	21	30.0	24.6	84.3
25	24	30.4	25.1	20	21	30.0	24.6	45.9
26	27	30.4	25.1	20	21	30.0	24.6	82.2
27	26	30.4	25.1	20	21	30.0	24.6	55.7
28	29	30.4	25.1	20	21	30.0	24.6	69.2
29	28	30.4	25.1	20	21	30.0	24.6	95.8
30	31	31.8	24.7	20	21	30.0	24.6	91.0
31	30	31.8	24.7	20	21	30.0	24.6	97.2
32	33	31.8	24.7	20	21	30.0	24.6	78.4
33	32	31.8	24.7	20	21	30.0	24.6	88.1
34	35	30.4	24.7	20	21	30.0	24.6	82.7
35	34	30.4	24.7	20	21	30.0	24.6	92.3
1	2	12.4	33.0	21	20	30.0	24.6	103.2
2	1	12.4	33.0	21	20	30.0	24.6	103.0
2	3	8.8	33.0	21	20	30.0	24.6	91.9
2	4	21.7	33.0	21	20	30.0	24.6	96.7
3	2	8.8	33.0	21	20	30.0	24.6	82.2
3	5	-20.2	33.0	21	20	30.0	24.6	76.8
4	2	21.7	33.0	21	20	30.0	24.6	87.2
4	6	9.5	33.0	21	20	30.0	24.6	87.8
4	7	21.4	33.0	21	20	30.0	24.6	90.0
5	3	-20.2	33.0	21	20	30.0	24.6	66.8
6	4	9.5	33.0	21	20	30.0	24.6	97.7
7	4	21.4	33.0	21	20	30.0	24.6	96.6
7	8	8.1	33.0	21	20	30.0	24.6	105.7
7	9	16.9	33.0	21	20	30.0	24.6	83.6
8	7	-6.9	33.0	21	20	30.0	24.6	100.7
9	7	16.9	33.0	21	20	30.0	24.6	96.1
9	10	5.8	33.0	21	20	30.0	24.6	75.7
9	11	8.8	33.0	21	20	30.0	24.6	84.2
10	9	0.8	33.0	21	20	30.0	24.6	87.6
11	9	8.8	33.0	21	20	30.0	24.6	84.6
11	12	8.1	33.0	21	20	30.0	24.6	74.3
11	13	18.3	33.0	21	20	30.0	24.6	82.9
12	11	8.1	33.0	21	20	30.0	24.6	84.2
13	11	18.3	33.0	21	20	30.0	24.6	69.2
13	14	10.7	33.0	21	20	30.0	24.6	74.2
13	15	21.9	33.0	21	20	30.0	24.6	81.9
14	13	10.7	33.0	21	20	30.0	24.6	83.9
15	13	21.9	33.0	21	20	30.0	24.6	78.9
15	16	0.3	33.0	21	20	30.0	24.6	77.9
15	17	1.1	33.0	21	20	30.0	24.6	67.9
16	15	0.3	33.0	21	20	30.0	24.6	67.9
17	15	1.1	33.0	21	20	30.0	24.6	77.9
18	19	18.4	24.6	21	20	30.0	24.6	88.4
19	18	18.4	24.6	21	20	30.0	24.6	87.7

X FOR DIST = 0.10000D+01
X FOR DIST = 0.10000D+01

20	21	30.0	24.6	21	20	30.0	24.6	-33.4
22	23	30.0	24.2	21	20	30.0	24.6	-57.8
23	22	30.0	24.2	21	20	30.0	24.6	38.6
24	25	30.4	25.1	21	20	30.0	24.6	100.9
25	24	30.4	25.1	21	20	30.0	24.6	62.5
26	27	30.4	25.1	21	20	30.0	24.6	102.8
27	26	30.4	25.1	21	20	30.0	24.6	76.3
28	29	30.4	25.1	21	20	30.0	24.6	66.8
29	28	30.4	25.1	21	20	30.0	24.6	105.4
30	31	31.8	24.7	21	20	30.0	24.6	100.6
31	30	31.8	24.7	21	20	30.0	24.6	106.8
32	33	31.8	24.7	21	20	30.0	24.6	95.1
33	32	31.8	24.7	21	20	30.0	24.6	104.7
34	35	30.4	24.7	21	20	30.0	24.6	86.5
35	34	30.4	24.7	21	20	30.0	24.6	96.1
1	2	12.4	33.0	22	23	30.0	24.2	98.6

2	1	12.4	33.0	22	23	30.0	24.2	92.3
2	3	8.8	33.0	22	23	30.0	24.2	86.9
2	4	21.7	33.0	22	23	30.0	24.2	91.6
3	2	8.8	33.0	22	23	30.0	24.2	70.6
3	5	-20.2	33.0	22	23	30.0	24.2	71.9
4	2	21.7	33.0	22	23	30.0	24.2	82.6
4	6	9.5	33.0	22	23	30.0	24.2	82.8
4	7	21.4	33.0	22	23	30.0	24.2	84.4
5	3	-20.2	33.0	22	23	30.0	24.2	61.9
6	4	9.5	33.0	22	23	30.0	24.2	92.5
7	4	21.4	33.0	22	23	30.0	24.2	91.5
7	8	8.1	33.0	22	23	30.0	24.2	100.1
7	9	16.9	33.0	22	23	30.0	24.2	83.7
8	7	-6.9	33.0	22	23	30.0	24.2	95.1
9	7	16.9	33.0	22	23	30.0	24.2	90.5
9	10	5.8	33.0	22	23	30.0	24.2	75.9
9	11	8.8	33.0	22	23	30.0	24.2	78.0
10	9	0.8	33.0	22	23	30.0	24.2	87.7
11	9	8.8	33.0	22	23	30.0	24.2	84.7
11	12	8.1	33.0	22	23	30.0	24.2	74.4
11	13	18.3	33.0	22	23	30.0	24.2	78.9
12	11	8.1	33.0	22	23	30.0	24.2	84.0
13	11	18.3	33.0	22	23	30.0	24.2	89.0
13	14	10.7	33.0	22	23	30.0	24.2	74.8
13	15	21.9	33.0	22	23	30.0	24.2	81.7
14	13	10.7	33.0	22	23	30.0	24.2	83.9
15	13	21.9	33.0	22	23	30.0	24.2	78.9
15	16	0.3	33.0	22	23	30.0	24.2	77.3
15	17	1.1	33.0	22	23	30.0	24.2	68.2
16	15	0.3	33.0	22	23	30.0	24.2	67.7
17	15	1.1	33.0	22	23	30.0	24.2	77.7
18	19	18.4	24.6	22	23	30.0	24.2	56.0
19	18	18.4	24.6	22	23	30.0	24.2	56.4
20	21	30.0	24.6	22	23	30.0	24.2	57.4
21	20	30.0	24.6	22	23	30.0	24.2	41.3
23	22	30.0	24.2	22	23	30.0	24.2	-70.1
24	25	30.4	25.1	22	23	30.0	24.2	96.8
25	24	30.4	25.1	22	23	30.0	24.2	70.6
26	27	30.4	25.1	22	23	30.0	24.2	99.6
27	26	30.4	25.1	22	23	30.0	24.2	100.4
28	29	30.4	25.1	22	23	30.0	24.2	65.2
29	28	30.4	25.1	22	23	30.0	24.2	101.6
30	31	31.8	24.7	22	23	30.0	24.2	96.4
31	30	31.8	24.7	22	23	30.0	24.2	102.6
32	33	31.8	24.7	22	23	30.0	24.2	91.4
33	32	31.8	24.7	22	23	30.0	24.2	100.9
34	35	30.4	24.7	22	23	30.0	24.2	83.0
35	34	30.4	24.7	22	23	30.0	24.2	99.3
1	2	12.4	33.0	23	22	30.0	24.2	76.6
2	1	12.4	33.0	23	22	30.0	24.2	76.4
2	3	8.8	33.0	23	22	30.0	24.2	65.3
2	4	21.7	33.0	23	22	30.0	24.2	58.1
3	2	8.8	33.0	23	22	30.0	24.2	55.6
3	5	-20.2	33.0	23	22	30.0	24.2	50.2
4	2	21.7	33.0	23	22	30.0	24.2	60.6
4	6	9.5	33.0	23	22	30.0	24.2	49.2
4	7	21.4	33.0	23	22	30.0	24.2	63.4
5	3	-20.2	33.0	23	22	30.0	24.2	40.2
6	4	9.5	33.0	23	22	30.0	24.2	59.1
7	4	21.4	33.0	23	22	30.0	24.2	56.0
7	8	8.1	33.0	23	22	30.0	24.2	79.1
7	9	16.9	33.0	23	22	30.0	24.2	67.0
8	7	-6.9	33.0	23	22	30.0	24.2	74.1
9	7	16.9	33.0	23	22	30.0	24.2	67.5
9	10	5.8	33.0	23	22	30.0	24.2	50.1
9	11	8.8	33.0	23	22	30.0	24.2	69.6

10	9	0.8	33.0	23	22	30.0	24.2	73.0
11	9	8.8	33.0	23	22	30.0	24.2	70.0
11	12	8.1	33.0	23	22	30.0	24.2	59.7
11	13	18.3	33.0	23	22	30.0	24.2	72.3
12	11	8.1	33.0	23	22	30.0	24.2	69.6
13	11	18.3	33.0	23	22	30.0	24.2	74.6
13	14	10.7	33.0	23	22	30.0	24.2	63.6
13	15	21.9	33.0	23	22	30.0	24.2	71.3
14	13	10.7	33.0	23	22	30.0	24.2	73.3
15	13	21.9	33.0	23	22	30.0	24.2	68.3
15	16	0.3	33.0	23	22	30.0	24.2	67.3
15	17	1.1	33.0	23	22	30.0	24.2	57.3
16	15	0.3	33.0	23	22	30.0	24.2	57.3
17	15	1.1	33.0	23	22	30.0	24.2	67.3
18	19	18.4	24.6	23	22	30.0	24.2	67.8
19	18	18.4	24.6	23	22	30.0	24.2	67.1
20	21	30.0	24.6	23	22	30.0	24.2	-39.0
21	20	30.0	24.6	23	22	30.0	24.2	39.4
22	23	30.0	24.2	23	22	30.0	24.2	-63.4
24	25	30.4	25.1	23	22	30.0	24.2	80.3
25	24	30.4	25.1	23	22	30.0	24.2	41.9
26	27	30.4	25.1	23	22	30.0	24.2	86.2
27	26	30.4	25.1	23	22	30.0	24.2	59.7
28	29	30.4	25.1	23	22	30.0	24.2	40.2
29	28	30.4	25.1	23	22	30.0	24.2	78.8
30	31	31.8	24.7	23	22	30.0	24.2	62.0
31	30	31.8	24.7	23	22	30.0	24.2	68.2
32	33	31.8	24.7	23	22	30.0	24.2	56.5
33	32	31.8	24.7	23	22	30.0	24.2	66.1
34	35	30.4	24.7	23	22	30.0	24.2	82.9
35	34	30.4	24.7	23	22	30.0	24.2	92.5
1	2	12.4	33.0	24	25	30.4	25.1	93.8
2	1	12.4	33.0	24	25	30.4	25.1	84.1
2	3	8.8	33.0	24	25	30.4	25.1	72.6
2	4	21.7	33.0	24	25	30.4	25.1	80.2
3	2	8.8	33.0	24	25	30.4	25.1	72.8
3	5	-20.2	33.0	24	25	30.4	25.1	67.3
4	2	21.7	33.0	24	25	30.4	25.1	77.8
4	6	9.5	33.0	24	25	30.4	25.1	77.4
4	7	21.4	33.0	24	25	30.4	25.1	49.7
5	3	-20.2	33.0	24	25	30.4	25.1	50.5
6	4	9.5	33.0	24	25	30.4	25.1	81.2
7	4	21.4	33.0	24	25	30.4	25.1	86.2
7	8	8.1	33.0	24	25	30.4	25.1	98.4
7	9	16.9	33.0	24	25	30.4	25.1	68.9
8	7	-6.9	33.0	24	25	30.4	25.1	87.4
9	7	16.9	33.0	24	25	30.4	25.1	88.8
9	10	5.8	33.0	24	25	30.4	25.1	86.8
9	11	8.8	33.0	24	25	30.4	25.1	68.6
10	9	0.8	33.0	24	25	30.4	25.1	77.9
11	9	8.8	33.0	24	25	30.4	25.1	84.9
11	12	8.1	33.0	24	25	30.4	25.1	76.2
11	13	18.3	33.0	24	25	30.4	25.1	64.8
12	11	8.1	33.0	24	25	30.4	25.1	85.7
13	11	18.3	33.0	24	25	30.4	25.1	90.6
13	14	10.7	33.0	24	25	30.4	25.1	77.3
13	15	21.9	33.0	24	25	30.4	25.1	76.2
14	13	10.7	33.0	24	25	30.4	25.1	80.8
15	13	21.9	33.0	24	25	30.4	25.1	91.8
15	16	0.3	33.0	24	25	30.4	25.1	82.9
15	17	1.1	33.0	24	25	30.4	25.1	66.6
16	15	0.3	33.0	24	25	30.4	25.1	66.2
17	15	1.1	33.0	24	25	30.4	25.1	83.2
18	19	18.4	24.6	24	25	30.4	25.1	53.6
19	18	18.4	24.6	24	25	30.4	25.1	36.9
20	21	30.0	24.6	24	25	30.4	25.1	64.3

21	20	30.0	24.6	24	25	30.4	25.1	47.7
22	23	30.0	24.2	24	25	30.4	25.1	25.0
23	22	30.0	24.2	24	25	30.4	25.1	53.9
25	24	30.4	25.1	24	25	30.4	25.1	-55.7
26	27	30.4	25.1	24	25	30.4	25.1	69.9
27	26	30.4	25.1	24	25	30.4	25.1	81.1
28	29	30.4	25.1	24	25	30.4	25.1	84.4
29	28	30.4	25.1	24	25	30.4	25.1	88.1
30	31	31.8	24.7	24	25	30.4	25.1	76.9
31	30	31.8	24.7	24	25	30.4	25.1	92.3
32	33	31.8	24.7	24	25	30.4	25.1	71.1
33	32	31.8	24.7	24	25	30.4	25.1	79.1
34	35	30.4	24.7	24	25	30.4	25.1	90.0
35	34	30.4	24.7	24	25	30.4	25.1	99.4
1	2	12.4	33.0	25	24	30.4	25.1	86.9
2	1	12.4	33.0	25	24	30.4	25.1	77.2
2	3	8.8	33.0	25	24	30.4	25.1	69.5
2	4	21.7	33.0	25	24	30.4	25.1	72.6
3	2	8.8	33.0	25	24	30.4	25.1	66.0
3	5	-20.2	33.0	25	24	30.4	25.1	60.1
4	2	21.7	33.0	25	24	30.4	25.1	71.0
4	6	9.5	33.0	25	24	30.4	25.1	70.0
4	7	21.4	33.0	25	24	30.4	25.1	60.5
5	3	-20.2	33.0	25	24	30.4	25.1	33.4
6	4	9.5	33.0	25	24	30.4	25.1	73.6
7	4	21.4	33.0	25	24	30.4	25.1	78.6
7	8	8.1	33.0	25	24	30.4	25.1	91.2
7	9	16.9	33.0	25	24	30.4	25.1	65.8
8	7	-6.9	33.0	25	24	30.4	25.1	80.1
9	7	16.9	33.0	25	24	30.4	25.1	81.5
9	10	0.8	33.0	25	24	30.4	25.1	79.6
9	11	8.8	33.0	25	24	30.4	25.1	68.5
10	9	0.8	33.0	25	24	30.4	25.1	70.8
11	9	8.8	33.0	25	24	30.4	25.1	77.8
11	12	8.1	33.0	25	24	30.4	25.1	62.2
11	13	18.3	33.0	25	24	30.4	25.1	45.9
12	11	8.1	33.0	25	24	30.4	25.1	78.6
13	11	18.3	33.0	25	24	30.4	25.1	83.5
13	14	10.7	33.0	25	24	30.4	25.1	70.5
13	15	21.9	33.0	25	24	30.4	25.1	69.3
14	13	10.7	33.0	25	24	30.4	25.1	73.8
15	13	21.9	33.0	25	24	30.4	25.1	84.9
15	16	0.3	33.0	25	24	30.4	25.1	81.9
15	17	1.1	33.0	25	24	30.4	25.1	59.7
16	15	0.3	33.0	25	24	30.4	25.1	59.3
17	15	1.1	33.0	25	24	30.4	25.1	76.3
18	19	18.4	24.6	25	24	30.4	25.1	91.5
19	18	18.4	24.6	25	24	30.4	25.1	70.9
20	21	30.0	24.6	25	24	30.4	25.1	102.7
21	20	30.0	24.6	25	24	30.4	25.1	86.1
22	23	30.0	24.2	25	24	30.4	25.1	63.3
23	22	30.0	24.2	25	24	30.4	25.1	79.8
24	25	30.4	25.1	25	24	30.4	25.1	-50.8
26	27	30.4	25.1	25	24	30.4	25.1	71.0
27	26	30.4	25.1	25	24	30.4	25.1	78.8
28	29	30.4	25.1	25	24	30.4	25.1	74.7
29	28	30.4	25.1	25	24	30.4	25.1	78.0
30	31	31.8	24.7	25	24	30.4	25.1	73.4
31	30	31.8	24.7	25	24	30.4	25.1	82.1
32	33	31.8	24.7	25	24	30.4	25.1	52.4
33	32	31.8	24.7	25	24	30.4	25.1	76.3
34	35	30.4	24.7	25	24	30.4	25.1	76.7
35	34	30.4	24.7	25	24	30.4	25.1	93.1
1	2	12.4	33.0	26	27	30.4	25.1	97.7
2	1	12.4	33.0	26	27	30.4	25.1	87.9
2	3	8.8	33.0	26	27	30.4	25.1	80.4

2	4	21.7	33.0	26	27	30.4	25.1	84.7
3	2	8.8	33.0	26	27	30.4	25.1	76.7
3	5	-20.2	33.0	26	27	30.4	25.1	71.4
4	2	21.7	33.0	26	27	30.4	25.1	81.8
4	6	9.5	33.0	26	27	30.4	25.1	81.8
4	7	21.4	33.0	26	27	30.4	25.1	65.2
5	3	-20.2	33.0	26	27	30.4	25.1	50.5
6	4	9.5	33.0	26	27	30.4	25.1	85.6
7	4	21.4	33.0	26	27	30.4	25.1	90.6
7	8	8.1	33.0	26	27	30.4	25.1	101.9
7	9	16.9	33.0	26	27	30.4	25.1	76.0
8	7	-6.9	33.0	26	27	30.4	25.1	90.9
9	7	16.9	33.0	26	27	30.4	25.1	92.2
9	10	5.8	33.0	26	27	30.4	25.1	89.9
9	11	8.8	33.0	26	27	30.4	25.1	78.5
10	9	0.8	33.0	26	27	30.4	25.1	81.0
11	9	8.8	33.0	26	27	30.4	25.1	88.0
11	12	8.1	33.0	26	27	30.4	25.1	78.9
11	13	18.3	33.0	26	27	30.4	25.1	55.4
12	11	8.1	33.0	26	27	30.4	25.1	88.5
13	11	18.3	33.0	26	27	30.4	25.1	93.5
13	14	10.7	33.0	26	27	30.4	25.1	79.8
13	15	21.9	33.0	26	27	30.4	25.1	85.3
14	13	10.7	33.0	26	27	30.4	25.1	83.3
15	13	21.9	33.0	26	27	30.4	25.1	94.4
15	16	0.3	33.0	26	27	30.4	25.1	85.1
15	17	1.1	33.0	26	27	30.4	25.1	64.7
16	15	0.3	33.0	26	27	30.4	25.1	68.4
17	15	1.1	33.0	26	27	30.4	25.1	85.4
18	19	18.4	24.6	26	27	30.4	25.1	93.9
19	18	18.4	24.6	26	27	30.4	25.1	55.3
20	21	30.0	24.6	26	27	30.4	25.1	77.2
21	20	30.0	24.6	26	27	30.4	25.1	56.6
22	23	30.0	24.2	26	27	30.4	25.1	41.8
23	22	30.0	24.2	26	27	30.4	25.1	82.5
24	25	30.4	25.1	26	27	30.4	25.1	77.9
25	24	30.4	25.1	26	27	30.4	25.1	80.1
27	26	30.4	25.1	26	27	30.4	25.1	-56.0
28	29	30.4	25.1	26	27	30.4	25.1	88.3
29	28	30.4	25.1	26	27	30.4	25.1	88.2
30	31	31.8	24.7	26	27	30.4	25.1	81.9
31	30	31.8	24.7	26	27	30.4	25.1	98.0
32	33	31.8	24.7	26	27	30.4	25.1	84.4
33	32	31.8	24.7	26	27	30.4	25.1	87.4
34	35	30.4	24.7	26	27	30.4	25.1	91.8
35	34	30.4	24.7	26	27	30.4	25.1	101.4
1	2	12.4	33.0	27	26	30.4	25.1	91.1
2	1	12.4	33.0	27	26	30.4	25.1	81.3
2	3	8.8	33.0	27	26	30.4	25.1	73.9
2	4	21.7	33.0	27	26	30.4	25.1	77.8
3	2	8.8	33.0	27	26	30.4	25.1	70.2
3	5	-20.2	33.0	27	26	30.4	25.1	64.7
4	2	21.7	33.0	27	26	30.4	25.1	75.2
4	6	9.5	33.0	27	26	30.4	25.1	75.0
4	7	21.4	33.0	27	26	30.4	25.1	64.5
5	3	-20.2	33.0	27	26	30.4	25.1	37.8
6	4	9.5	33.0	27	26	30.4	25.1	78.8
7	4	21.4	33.0	27	26	30.4	25.1	83.8
7	8	8.1	33.0	27	26	30.4	25.1	95.2
7	9	16.9	33.0	27	26	30.4	25.1	69.3
8	7	-6.9	33.0	27	26	30.4	25.1	84.1
9	7	16.9	33.0	27	26	30.4	25.1	85.5
9	10	5.8	33.0	27	26	30.4	25.1	83.2
9	11	8.8	33.0	27	26	30.4	25.1	71.8
10	9	0.8	33.0	27	26	30.4	25.1	74.3
11	9	8.8	33.0	27	26	30.4	25.1	81.3

11	12	8.1	33.0	27	26	30.4	25.1	65.3
11	13	18.3	33.0	27	26	30.4	25.1	48.7
12	11	8.1	33.0	27	26	30.4	25.1	81.8
13	11	18.3	33.0	27	26	30.4	25.1	66.6
13	14	10.7	33.0	27	26	30.4	25.1	73.2
13	15	21.9	33.0	27	26	30.4	25.1	78.7
14	13	10.7	33.0	27	26	30.4	25.1	62.7
15	13	21.9	33.0	27	26	30.4	25.1	87.7
15	16	0.3	33.0	27	26	30.4	25.1	64.5
15	17	1.1	33.0	27	26	30.4	25.1	56.1
16	15	0.3	33.0	27	26	30.4	25.1	61.8
17	15	1.1	33.0	27	26	30.4	25.1	78.8
18	19	18.4	24.6	27	26	30.4	25.1	93.1
19	18	18.4	24.6	27	26	30.4	25.1	54.5
20	21	30.0	24.6	27	26	30.4	25.1	103.7
21	20	30.0	24.6	27	26	30.4	25.1	65.0
22	23	30.0	24.2	27	26	30.4	25.1	66.3
23	22	30.0	24.2	27	26	30.4	25.1	61.7
24	25	30.4	25.1	27	26	30.4	25.1	70.0
25	24	30.4	25.1	27	26	30.4	25.1	65.9
26	27	30.4	25.1	27	26	30.4	25.1	-60.6
28	29	30.4	25.1	27	26	30.4	25.1	78.1
29	28	30.4	25.1	27	26	30.4	25.1	85.9
30	31	31.8	24.7	27	26	30.4	25.1	75.4
31	30	31.8	24.7	27	26	30.4	25.1	91.5
32	33	31.8	24.7	27	26	30.4	25.1	74.1
33	32	31.8	24.7	27	26	30.4	25.1	80.8
34	35	30.4	24.7	27	26	30.4	25.1	85.6
35	34	30.4	24.7	27	26	30.4	25.1	95.1
1	2	12.4	33.0	28	29	30.4	25.1	85.2
2	1	12.4	33.0	28	29	30.4	25.1	69.3
2	3	8.8	33.0	28	29	30.4	25.1	66.3
2	4	21.7	33.0	28	29	30.4	25.1	72.8
3	2	8.8	33.0	28	29	30.4	25.1	68.3
3	5	-20.2	33.0	28	29	30.4	25.1	51.2
4	2	21.7	33.0	28	29	30.4	25.1	73.3
4	6	9.5	33.0	28	29	30.4	25.1	62.8
4	7	21.4	33.0	28	29	30.4	25.1	74.6
5	3	-20.2	33.0	28	29	30.4	25.1	51.2
6	4	9.5	33.0	28	29	30.4	25.1	66.8
7	4	21.4	33.0	28	29	30.4	25.1	76.8
7	8	8.1	33.0	28	29	30.4	25.1	98.2
7	9	16.9	33.0	28	29	30.4	25.1	76.2
8	7	-6.9	33.0	28	29	30.4	25.1	79.2
9	7	16.9	33.0	28	29	30.4	25.1	84.6
9	10	5.8	33.0	28	29	30.4	25.1	68.9
9	11	8.8	33.0	28	29	30.4	25.1	65.3
10	9	0.8	33.0	28	29	30.4	25.1	45.2
11	9	8.8	33.0	28	29	30.4	25.1	81.2
11	12	8.1	33.0	28	29	30.4	25.1	72.6
11	13	18.3	33.0	28	29	30.4	25.1	78.6
12	11	8.1	33.0	28	29	30.4	25.1	76.4
13	11	18.3	33.0	28	29	30.4	25.1	81.3
13	14	10.7	33.0	28	29	30.4	25.1	73.8
13	15	21.9	33.0	28	29	30.4	25.1	51.7
14	13	10.7	33.0	28	29	30.4	25.1	73.6
15	13	21.9	33.0	28	29	30.4	25.1	88.6
15	16	0.3	33.0	28	29	30.4	25.1	74.5
15	17	1.1	33.0	28	29	30.4	25.1	71.1
16	15	0.3	33.0	28	29	30.4	25.1	70.7
17	15	1.1	33.0	28	29	30.4	25.1	74.7
18	19	18.4	24.6	28	29	30.4	25.1	86.8
19	18	18.4	24.6	28	29	30.4	25.1	83.0
20	21	30.0	24.6	28	29	30.4	25.1	103.2
21	20	30.0	24.6	28	29	30.4	25.1	93.6
22	23	30.0	24.2	28	29	30.4	25.1	57.9

23	22	30.0	24.2	28	29	30.4	25.1	80.6
24	25	30.4	25.1	28	29	30.4	25.1	74.0
25	24	30.4	25.1	28	29	30.4	25.1	84.0
26	27	30.4	25.1	28	29	30.4	25.1	82.8
27	26	30.4	25.1	28	29	30.4	25.1	85.2

X FOR DIST = 0.10000D+01
X FOR DIST = 0.10000D+01

29	28	30.4	25.1	28	29	30.4	25.1	-46.7
30	31	31.8	24.7	28	29	30.4	25.1	72.2
31	30	31.8	24.7	28	29	30.4	25.1	70.4
32	33	31.8	24.7	28	29	30.4	25.1	77.3
33	32	31.8	24.7	28	29	30.4	25.1	69.1
34	35	30.4	24.7	28	29	30.4	25.1	80.2
35	34	30.4	24.7	28	29	30.4	25.1	83.5
1	2	12.4	33.0	29	28	30.4	25.1	61.0
2	1	12.4	33.0	29	28	30.4	25.1	50.8
2	3	8.8	33.0	29	28	30.4	25.1	29.6
2	4	21.7	33.0	29	28	30.4	25.1	53.7
3	2	8.8	33.0	29	28	30.4	25.1	50.0
3	5	-20.2	33.0	29	28	30.4	25.1	14.5
4	2	21.7	33.0	29	28	30.4	25.1	49.0
4	6	9.5	33.0	29	28	30.4	25.1	58.0
4	7	21.4	33.0	29	28	30.4	25.1	49.2
5	3	-20.2	33.0	29	28	30.4	25.1	14.5
6	4	9.5	33.0	29	28	30.4	25.1	54.7
7	4	21.4	33.0	29	28	30.4	25.1	57.7
7	8	8.1	33.0	29	28	30.4	25.1	72.8
7	9	16.9	33.0	29	28	30.4	25.1	56.5
8	7	-6.9	33.0	29	28	30.4	25.1	53.8
9	7	16.9	33.0	29	28	30.4	25.1	59.2
9	10	5.8	33.0	29	28	30.4	25.1	69.2
9	11	8.8	33.0	29	28	30.4	25.1	45.5
10	9	0.8	33.0	29	28	30.4	25.1	25.5
11	9	8.8	33.0	29	28	30.4	25.1	61.5
11	12	8.1	33.0	29	28	30.4	25.1	56.7
11	13	18.3	33.0	29	28	30.4	25.1	62.6
12	11	8.1	33.0	29	28	30.4	25.1	52.5
13	11	18.3	33.0	29	28	30.4	25.1	61.5
13	14	10.7	33.0	29	28	30.4	25.1	57.7
13	15	21.9	33.0	29	28	30.4	25.1	47.5
14	13	10.7	33.0	29	28	30.4	25.1	57.5
15	13	21.9	33.0	29	28	30.4	25.1	72.6
15	16	0.3	33.0	29	28	30.4	25.1	58.3
15	17	1.1	33.0	29	28	30.4	25.1	54.8
16	15	0.3	33.0	29	28	30.4	25.1	54.5
17	15	1.1	33.0	29	28	30.4	25.1	58.5
18	19	18.4	24.6	29	28	30.4	25.1	60.4
19	18	18.4	24.6	29	28	30.4	25.1	44.6
20	21	30.0	24.6	29	28	30.4	25.1	64.6
21	20	30.0	24.6	29	28	30.4	25.1	66.9
22	23	30.0	24.2	29	28	30.4	25.1	19.3
23	22	30.0	24.2	29	28	30.4	25.1	42.2
24	25	30.4	25.1	29	28	30.4	25.1	70.7
25	24	30.4	25.1	29	28	30.4	25.1	80.4
26	27	30.4	25.1	29	28	30.4	25.1	75.0
27	26	30.4	25.1	29	28	30.4	25.1	85.3

X FOR DIST = 0.10000D+01
X FOR DIST = 0.10000D+01

28	29	30.4	25.1	29	28	30.4	25.1	88.3
30	31	31.8	24.7	29	28	30.4	25.1	60.7
31	30	31.8	24.7	29	28	30.4	25.1	68.4
32	33	31.8	24.7	29	28	30.4	25.1	77.4
33	32	31.8	24.7	29	28	30.4	25.1	69.6
34	35	30.4	24.7	29	28	30.4	25.1	86.4
35	34	30.4	24.7	29	28	30.4	25.1	89.8
1	2	12.4	33.0	30	31	31.8	24.7	58.6

10	9	0.8	33.0	31	30	31.8	24.7	61.1
11	9	8.8	33.0	31	30	31.8	24.7	79.0
11	12	8.1	33.0	31	30	31.8	24.7	70.9
11	13	18.3	33.0	31	30	31.8	24.7	70.0
12	11	8.1	33.0	31	30	31.8	24.7	74.4
13	11	18.3	33.0	31	30	31.8	24.7	85.4
13	14	10.7	33.0	31	30	31.8	24.7	72.5
13	15	21.9	33.0	31	30	31.8	24.7	62.2
14	13	10.7	33.0	31	30	31.8	24.7	76.0
15	13	21.9	33.0	31	30	31.8	24.7	87.0
15	16	0.3	33.0	31	30	31.8	24.7	72.9
15	17	1.1	33.0	31	30	31.8	24.7	69.7
16	15	0.3	33.0	31	30	31.8	24.7	69.3
17	15	1.1	33.0	31	30	31.8	24.7	73.3
18	19	18.4	24.6	31	30	31.8	24.7	84.9
19	18	18.4	24.6	31	30	31.8	24.7	75.2
20	21	30.0	24.6	31	30	31.8	24.7	95.7
21	20	30.0	24.6	31	30	31.8	24.7	86.1
22	23	30.0	24.2	31	30	31.8	24.7	38.4
23	22	30.0	24.2	31	30	31.8	24.7	72.8
24	25	30.4	25.1	31	30	31.8	24.7	66.7
25	24	30.4	25.1	31	30	31.8	24.7	70.2
26	27	30.4	25.1	31	30	31.8	24.7	69.6
27	26	30.4	25.1	31	30	31.8	24.7	76.2
28	29	30.4	25.1	31	30	31.8	24.7	58.0
29	28	30.4	25.1	31	30	31.8	24.7	69.5
30	31	31.8	24.7	31	30	31.8	24.7	-57.1
32	33	31.8	24.7	31	30	31.8	24.7	67.7
33	32	31.8	24.7	31	30	31.8	24.7	48.3
34	35	30.4	24.7	31	30	31.8	24.7	85.9
35	34	30.4	24.7	31	30	31.8	24.7	95.1
1	2	12.4	33.0	32	33	31.8	24.7	79.6
2	1	12.4	33.0	32	33	31.8	24.7	63.2
2	3	8.8	33.0	32	33	31.8	24.7	58.7
2	4	21.7	33.0	32	33	31.8	24.7	66.5
3	2	8.8	33.0	32	33	31.8	24.7	58.6
3	5	-20.2	33.0	32	33	31.8	24.7	53.4
4	2	21.7	33.0	32	33	31.8	24.7	63.7
4	6	9.5	33.0	32	33	31.8	24.7	63.4
4	7	21.4	33.0	32	33	31.8	24.7	54.7
5	3	-20.2	33.0	32	33	31.8	24.7	43.6
6	4	9.5	33.0	32	33	31.8	24.7	67.5
7	4	21.4	33.0	32	33	31.8	24.7	76.5
7	8	8.1	33.0	32	33	31.8	24.7	85.4
7	9	16.9	33.0	32	33	31.8	24.7	38.3
8	7	-6.9	33.0	32	33	31.8	24.7	74.4
9	7	16.9	33.0	32	33	31.8	24.7	75.7
9	10	5.8	33.0	32	33	31.8	24.7	80.0
9	11	8.8	33.0	32	33	31.8	24.7	52.1
10	9	0.8	33.0	32	33	31.8	24.7	58.3
11	9	8.8	33.0	32	33	31.8	24.7	72.2
11	12	8.1	33.0	32	33	31.8	24.7	63.7
11	13	18.3	33.0	32	33	31.8	24.7	62.5
12	11	8.1	33.0	32	33	31.8	24.7	67.2
13	11	18.3	33.0	32	33	31.8	24.7	78.2
13	14	10.7	33.0	32	33	31.8	24.7	65.0
13	15	21.9	33.0	32	33	31.8	24.7	68.2
14	13	10.7	33.0	32	33	31.8	24.7	68.5
15	13	21.9	33.0	32	33	31.8	24.7	79.5
15	16	0.3	33.0	32	33	31.8	24.7	74.8
15	17	1.1	33.0	32	33	31.8	24.7	54.6
16	15	0.3	33.0	32	33	31.8	24.7	65.2
17	15	1.1	33.0	32	33	31.8	24.7	75.2
18	19	18.4	24.6	32	33	31.8	24.7	91.5
19	18	18.4	24.6	32	33	31.8	24.7	74.9
20	21	30.0	24.6	32	33	31.8	24.7	102.3

21	20	30.0	24.6	32	33	31.8	24.7	85.6
22	23	30.0	24.2	32	33	31.8	24.7	44.9
23	22	30.0	24.2	32	33	31.8	24.7	79.6
24	25	30.4	25.1	32	33	31.8	24.7	72.0
25	24	30.4	25.1	32	33	31.8	24.7	74.8
26	27	30.4	25.1	32	33	31.8	24.7	77.5
27	26	30.4	25.1	32	33	31.8	24.7	84.1
28	29	30.4	25.1	32	33	31.8	24.7	69.4
29	28	30.4	25.1	32	33	31.8	24.7	68.8
30	31	31.8	24.7	32	33	31.8	24.7	50.7
31	30	31.8	24.7	32	33	31.8	24.7	74.3
33	32	31.8	24.7	32	33	31.8	24.7	-34.7
34	35	30.4	24.7	32	33	31.8	24.7	77.7
35	34	30.4	24.7	32	33	31.8	24.7	81.1
1	2	12.4	33.0	33	32	31.8	24.7	89.5
2	1	12.4	33.0	33	32	31.8	24.7	69.1
2	3	8.8	33.0	33	32	31.8	24.7	68.9
2	4	21.7	33.0	33	32	31.8	24.7	63.4
3	2	8.8	33.0	33	32	31.8	24.7	72.5
3	5	-20.2	33.0	33	32	31.8	24.7	57.6
4	2	21.7	33.0	33	32	31.8	24.7	73.5
4	6	9.5	33.0	33	32	31.8	24.7	78.1
4	7	21.4	33.0	33	32	31.8	24.7	69.1
5	3	-20.2	33.0	33	32	31.8	24.7	53.8
6	4	9.5	33.0	33	32	31.8	24.7	64.3
7	4	21.4	33.0	33	32	31.8	24.7	73.3
7	8	8.1	33.0	33	32	31.8	24.7	95.8
7	9	16.9	33.0	33	32	31.8	24.7	60.6
8	7	-6.9	33.0	33	32	31.8	24.7	80.7
9	7	16.9	33.0	33	32	31.8	24.7	86.1
9	10	5.8	33.0	33	32	31.8	24.7	90.3
9	11	8.8	33.0	33	32	31.8	24.7	44.4
10	9	0.8	33.0	33	32	31.8	24.7	68.6
11	9	8.8	33.0	33	32	31.8	24.7	82.5
11	12	8.1	33.0	33	32	31.8	24.7	73.9
11	13	18.3	33.0	33	32	31.8	24.7	72.7
12	11	8.1	33.0	33	32	31.8	24.7	77.5
13	11	18.3	33.0	33	32	31.8	24.7	88.5
13	14	10.7	33.0	33	32	31.8	24.7	75.1
13	15	21.9	33.0	33	32	31.8	24.7	64.4
14	13	10.7	33.0	33	32	31.8	24.7	78.7
15	13	21.9	33.0	33	32	31.8	24.7	89.7
15	16	0.3	33.0	33	32	31.8	24.7	75.1
15	17	1.1	33.0	33	32	31.8	24.7	71.7
16	15	0.3	33.0	33	32	31.8	24.7	71.4
17	15	1.1	33.0	33	32	31.8	24.7	81.4
18	19	18.4	24.6	33	32	31.8	24.7	82.0
19	18	18.4	24.6	33	32	31.8	24.7	65.4
20	21	30.0	24.6	33	32	31.8	24.7	92.6
21	20	30.0	24.6	33	32	31.8	24.7	75.9
22	23	30.0	24.2	33	32	31.8	24.7	35.2
23	22	30.0	24.2	33	32	31.8	24.7	70.1
24	25	30.4	25.1	33	32	31.8	24.7	48.1
25	24	30.4	25.1	33	32	31.8	24.7	66.8
26	27	30.4	25.1	33	32	31.8	24.7	70.8
27	26	30.4	25.1	33	32	31.8	24.7	81.1
28	29	30.4	25.1	33	32	31.8	24.7	77.1
29	28	30.4	25.1	33	32	31.8	24.7	77.0
30	31	31.8	24.7	33	32	31.8	24.7	70.1
31	30	31.8	24.7	33	32	31.8	24.7	83.6
32	33	31.8	24.7	33	32	31.8	24.7	-70.5
34	35	30.4	24.7	33	32	31.8	24.7	87.4
35	34	30.4	24.7	33	32	31.8	24.7	90.8
1	2	12.4	33.0	34	35	30.4	24.7	86.3
2	1	12.4	33.0	34	35	30.4	24.7	90.0
2	3	8.8	33.0	34	35	30.4	24.7	75.6

2	4	21.7	33.0	34	35	30.4	24.7	81.7
3	2	8.8	33.0	34	35	30.4	24.7	85.3
3	5	-20.2	33.0	34	35	30.4	24.7	31.7
4	2	21.7	33.0	34	35	30.4	24.7	90.3
4	6	9.5	33.0	34	35	30.4	24.7	92.4
4	7	21.4	33.0	34	35	30.4	24.7	90.2
5	3	-20.2	33.0	34	35	30.4	24.7	70.5
6	4	9.5	33.0	34	35	30.4	24.7	82.7
7	4	21.4	33.0	34	35	30.4	24.7	81.7
7	8	8.1	33.0	34	35	30.4	24.7	109.8
7	9	16.9	33.0	34	35	30.4	24.7	83.6
8	7	-6.9	33.0	34	35	30.4	24.7	77.9
9	7	16.9	33.0	34	35	30.4	24.7	80.2
9	10	5.8	33.0	34	35	30.4	24.7	92.6
9	11	8.8	33.0	34	35	30.4	24.7	78.3
10	9	0.8	33.0	34	35	30.4	24.7	77.6
11	9	8.8	33.0	34	35	30.4	24.7	74.5
11	12	8.1	33.0	34	35	30.4	24.7	83.5
11	13	18.3	33.0	34	35	30.4	24.7	43.3
12	11	8.1	33.0	34	35	30.4	24.7	63.4
13	11	18.3	33.0	34	35	30.4	24.7	79.3
13	14	10.7	33.0	34	35	30.4	24.7	82.0
13	15	21.9	33.0	34	35	30.4	24.7	78.7
14	13	10.7	33.0	34	35	30.4	24.7	23.3
15	13	21.9	33.0	34	35	30.4	24.7	49.4
15	16	0.3	33.0	34	35	30.4	24.7	69.1
15	17	1.1	33.0	34	35	30.4	24.7	72.4
16	15	0.3	33.0	34	35	30.4	24.7	72.8
17	15	1.1	33.0	34	35	30.4	24.7	68.7
18	19	18.4	24.6	34	35	30.4	24.7	83.8
19	18	18.4	24.6	34	35	30.4	24.7	83.8
20	21	30.0	24.6	34	35	30.4	24.7	96.9
21	20	30.0	24.6	34	35	30.4	24.7	93.1
22	23	30.0	24.2	34	35	30.4	24.7	74.5
23	22	30.0	24.2	34	35	30.4	24.7	81.3
24	25	30.4	25.1	34	35	30.4	24.7	92.0
25	24	30.4	25.1	34	35	30.4	24.7	98.4
26	27	30.4	25.1	34	35	30.4	24.7	95.0
27	26	30.4	25.1	34	35	30.4	24.7	101.3
28	27	30.4	25.1	34	35	30.4	24.7	92.8
29	28	30.4	25.1	34	35	30.4	24.7	86.5
30	31	31.8	24.7	34	35	30.4	24.7	100.7
31	30	31.8	24.7	34	35	30.4	24.7	74.4
32	33	31.8	24.7	34	35	30.4	24.7	94.1
33	32	31.8	24.7	34	35	30.4	24.7	94.4
35	34	30.4	24.7	34	35	30.4	24.7	-35.2
1	2	12.4	33.0	35	34	30.4	24.7	70.3
2	1	12.4	33.0	35	34	30.4	24.7	74.1
2	3	8.8	33.0	35	34	30.4	24.7	59.6
2	4	21.7	33.0	35	34	30.4	24.7	65.7
3	2	8.8	33.0	35	34	30.4	24.7	69.3
3	5	-20.2	33.0	35	34	30.4	24.7	15.7
4	2	21.7	33.0	35	34	30.4	24.7	74.3
4	6	9.5	33.0	35	34	30.4	24.7	76.4
4	7	21.4	33.0	35	34	30.4	24.7	68.3
5	3	-20.2	33.0	35	34	30.4	24.7	54.6
6	4	9.5	33.0	35	34	30.4	24.7	66.6
7	4	21.4	33.0	35	34	30.4	24.7	65.6
7	8	8.1	33.0	35	34	30.4	24.7	94.0
7	9	16.9	33.0	35	34	30.4	24.7	63.8
8	7	-6.9	33.0	35	34	30.4	24.7	62.0
9	7	16.9	33.0	35	34	30.4	24.7	64.4
9	10	5.8	33.0	35	34	30.4	24.7	72.8
9	11	8.8	33.0	35	34	30.4	24.7	52.6
10	9	0.8	33.0	35	34	30.4	24.7	57.8
11	9	8.8	33.0	35	34	30.4	24.7	54.8

11	12	8.1	33.0	35	34	30.4	24.7	46.0
11	13	18.3	33.0	35	34	30.4	24.7	83.8
12	11	8.1	33.0	35	34	30.4	24.7	41.7
13	11	18.3	33.0	35	34	30.4	24.7	53.6
13	14	10.7	33.0	35	34	30.4	24.7	44.7
13	15	21.9	33.0	35	34	30.4	24.7	63.1
14	13	10.7	33.0	35	34	30.4	24.7	63.8
15	13	21.9	33.0	35	34	30.4	24.7	89.8
15	16	0.3	33.0	35	34	30.4	24.7	49.4
15	17	1.1	33.0	35	34	30.4	24.7	56.8
16	15	0.3	33.0	35	34	30.4	24.7	57.1
17	15	1.1	33.0	35	34	30.4	24.7	53.1
18	19	18.4	24.6	35	34	30.4	24.7	67.5
19	18	18.4	24.6	35	34	30.4	24.7	67.5
20	21	30.0	24.6	35	34	30.4	24.7	87.3
21	20	30.0	24.6	35	34	30.4	24.7	83.5
22	23	30.0	24.2	35	34	30.4	24.7	64.9
23	22	30.0	24.2	35	34	30.4	24.7	65.0
24	25	30.4	25.1	35	34	30.4	24.7	75.7
25	24	30.4	25.1	35	34	30.4	24.7	89.0
26	27	30.4	25.1	35	34	30.4	24.7	85.5
27	26	30.4	25.1	35	34	30.4	24.7	91.8
28	29	30.4	25.1	35	34	30.4	24.7	89.4
29	28	30.4	25.1	35	34	30.4	24.7	83.2
30	31	31.8	24.7	35	34	30.4	24.7	91.5
31	30	31.8	24.7	35	34	30.4	24.7	71.1
32	33	31.8	24.7	35	34	30.4	24.7	90.7
33	32	31.8	24.7	35	34	30.4	24.7	81.0
34	35	30.4	24.7	35	34	30.4	24.7	-117.9

STOP --